THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE

UNIVERSAL ELECTRICAL DIRECTORY

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BRITISH TRADE ABROAD.

THE disturbed state of the labour world renders it impossible, or at any rate unwise, to attempt to make any particular deduction from the trade returns for the past month or two. We may have to wait until the end of the year before we shall be able to see exactly how things are going. Electrical exporting, however, seems to be proceeding at a fairly satisfactory rate, and the recently reported statements of manufacturing companies show that there is a great deal of foreign and colonial work in hand. British electrical firms are undoubtedly putting more zest into export trade development, and though the margin of profit even on this class of business is not all that is desired, the result is gratifying. We believe that the need for continuing to show a spirit of enterprise has not diminished. There is a multitude of markets to exploit, and there is a keenness in the method of the foreign competitor—one of which factors affords encouragement, if the other urges the argument of necessity.

The private trader may receive assistance in his future study of the prospective fields from the Imperial Trade Commission, which holds its first meeting in London next month. The members of this Commission will first, it is thought, make a close investigation into the trade conditions of the United Kingdom, and they will then journey from place to place armed with intelligence and authority, inquiring, we suppose, into the prospects of reciprocally strengthening our trade connections with them and opening up new channels for the inflow of the product of the British manufacturer. Therefore, we cannot reasonably expect to have the results of the inquiry in our hands for some time—one member says three years. In no sense can we look to a Government Commission to do for us as individual traders what we ought to do for ourselves. The necessity for individual enterprise and personal initiative is as imperatively demanded as it ever was.

In the *Chamber of Commerce Journal* for June there are two appeals to British traders and manufacturers which should command attention. One emanates from the Secretary of the Board of Trade at Calgary, urging the "business section of England" to pay proper heed to the opportunities for trade in Western Canada, and promising that those who take trouble to investigate these will be amply repaid. The writer (Mr. W. H. Wilson) says that the business men of the United States have not waited for a second invitation to participate, but possessing a full appreciation of the wonderful prospects of the future in this tremendous, but still very sparsely settled, territory, they are establishing themselves in Western Cities with plants large enough to handle present business, and reserving land for the all-assured extension. Our manufacturers would do well to communicate with Mr. Wilson at Calgary, for he is open to advise anybody who will carefully sound the propositions and send experts to test the advantages of the country.

This appeal comes at a moment when British electrical and engineering firms are giving evidence of a great awakening and an earnest desire in regard to Canada, and it will hardly require any additional support from us after the aggressive policy that we have so long and so consistently advocated in regard to this market.

The second appeal comes to the *Journal* from the British Vice-Consul at Ensenada, Baja California, Mexico. It relates to the approaching completion of the Panama Canal and the consequent extraordinary advantages that await the development of British trade in the North Pacific, if our traders, financiers and settlers are only properly alive to the possibilities of the situation for those who show reasonable enterprise in embracing opportunities as they arise.

Alert on the spot, watching matters at close range, Mr. W. D. Madden, the Consul referred to, says, "It is a most patent fact that unless we bestir ourselves with all the most modern enterprise and resourcefulness at our command, we shall be outstripped by other nations in the race for the great trade and commerce of this region." Everything that can be done by the United States and Germany to entrench themselves firmly, to the exclusion of all others, is being done, and the writer deplores the fact that we in this country seem inclined to apathy and inertness, combined sometimes with obsolete methods. This sounds like an old stereotyped criticism, but it appears to be justified in respect of this market. Obviously there is a pressing need there for British trading initiative. Mr. Madden goes on to show that he has a belief in his own people's ability to deal with the situation if the matter be given enough publicity in these islands.

We believe there is a great deal of reason for this plea for greater trade publicity. It is deplorable that our own newspapers nowadays are so filled with domestic political affairs, industrial differences, and a thousand comparatively small and petty matters, while they ought to be devoting their space freely to the great trading matters of the world, bringing it home to every trader and manufacturer, and to every worker too, how essential it is that Britain should assure her own necessary prosperity in the future by keeping her eyes ever open to the great development that is proceeding throughout the entire world, and to the opportunities thus opened to employer, worker, and investor alike. In our opinion the reports that are issued by British Consuls and commercial attachés abroad lose much of their real value because they are perused by so few, and are not served up in a suitable form for interested consumption, say over the average breakfast table, or in the cityward train. It has been argued that Consular reports are really not of much practical value to the manufacturer or exporter, except as a stimulus to first interest, which, in the proper course, should be followed up by a systematic investigation and trade-getting campaign. Maybe Mr. Madden bears in mind this criticism when he urges everybody British to read his reports issued down to, and including, that of, December, 1911. He will be content if the first stimulus be effectively aroused, for then, he says, the public will find both the settlers and the capital, and when these are provided a great trade and commerce can be "built up" in "British channels."

Turning our attention now to another market, where we hope to have greatly extended business relations almost immediately, we note with interest the observations of a correspondent of the *Times*, who, after a visit to the province of Hunan, writes home respecting a great Chinese trade revival which is in progress. Students of Chinese affairs know that the Hunanese include some of the finest men to be found in the whole of China, and they have afforded a new illustration of their superiority by sticking to their trading operations while the revolutionary fires were raging elsewhere. Here and in other parts the population is "heartily sick of politics," and is "desirous only of the restoration of confidence and the resumption of trade." We cannot resist the temptation to an aside upon the similarity of the current feeling in China to that which is growing in the British Isles. After a period of strife, wasting resources and effort in international war, or industrial conflict between capital and labour, or revolutionary conflict dethroning a monarch, all the nations must inevitably return, sooner or later, to normal living and to trading operations, and with deep feelings of relief and satisfaction. Let us hope that readjustments consequent upon upheavals will eventuate in greater prosperity for all.

If the present appearances in China are not misleading, it will not be long before the import trade assumes huge proportions. The spring trade at Hankau, "this fast-developing commercial emporium of Central China," is described as enormous. Accumulations have, however, now been cleared off, and there is every prospect of a continuation of the remarkable expansion noted there in recent years. The prospect seems to be encouraging to all British firms who have during the last few years laid schemes for securing some of the electrical and other engineering trade that the progress of modernisation and civilisation is sure to promote; the movement toward, let us hope, prolonged peaceful trading operations, is also, doubtless, being noted with satisfaction by the large number of leading engineering and electrical firms who have joined hands in the recently-formed British Engineers' Association, whose prime object is to promote and protect our interests in China.

Malingerers and the Workmen's Compensation Act.

A CASE was recently decided at the Huddersfield County Court in which the judge made some strong observations about a new form of malingering. It appeared that the employers of a miner made application to terminate or diminish the compensation payable on the ground that the man had recovered. He was said to be suffering from a curious visual disease known as "miner's nystagmus"—an affection of the eyes which is brought on by work in the pit. Two eminent members of the medical profession gave evidence to the effect that this man was able to bring on nystagmus at will, and that he was in fact doing so. A doctor called on the part of the workman admitted that a man can control and also aggravate all the symptoms of nystagmus, and make the disease last longer than it otherwise would. His Honour said: "I quite agree with the submission by the applicants in this case that the respondent was malingering or unduly and improperly prolonging the duration of the disease. Such a practice is grossly dishonest, and the sooner it is stopped the better. I am convinced that the respondent has been malingering in the sense that he has discovered and used means whereby he can produce within reasonable limits for such period as he desired all the symptoms of miner's nystagmus." As the man was still suffering from the complaint to some extent, compensation was not taken away altogether, but the award was reduced to 1d. per week. That a man will go the length described in this case serves to show the extent to which employers in other industries may be exploited. If these things be done by those who are entitled to claim benefits under the Workmen's Compensation Act, one trembles to think of what will happen when the Insurance Act comes into full force.

Open Specifications.

The subject of uncommercial specifications has often been mentioned in these columns, it being frequently averred that engineers put forward specifications which cannot be filled on commercial lines owing to obsolete articles being required, or that in one way or another the contractors are prevented from supplying commercial material. Much has been done by way of standardising such things as girders, pipe flanges, &c., and this has put contractors into a much better position in many respects. An engineer writes us that he recently determined to make a thoroughly open specification, and he left open almost every detail, merely specifying that his specification should be followed in the intention, its figures indicating the class of work and the strengths that should be afforded. And what was the result? A storm of abuse, because the specification was so open that no bill of quantities was given. Obviously a bill of quantities is out of the question in a specification which leaves the actual design open to the contractor. Not a single really satisfactory tender was received, and the engineer finally divided up the work among the several sub-contractors, selecting those he could rely upon to do good work, and, by picking out firms whom he knew to be competent in each special line, obtained better and cheaper results.

The same engineer tried again to secure tenders on a specification which left the contractor free to furnish his own standard plant, in everything but a few essential details which experience had shown were rarely produced satisfactorily by any manufacturing firm. Of the firms to whom the specification was sent to tender upon, just one-half went behind the engineer's back and communicated with his client, endeavouring to oust him from the job, representing that he knew nothing of the work, appealing to their own experience, and so on, and specially pushing their own very inferior details and methods in the very few items that were tied fast by the specification. The other half of the tenderers were all firms of better standing and longer experience than the above-mentioned firms; they put in offers that embraced the special points of the specification, and filled the open points substantially with things of their own pattern.

If engineers are to be exposed to such treatment as is described above, it is hardly a matter for surprise that the open specification does not appeal to them. By half the firms, the liberty was utilised to attempt to do the engineer serious injury—the engineer who had selected them to be among the recipients of the specification—while, in the first case, one firm at least became coarsely abusive.

There is thus another side to the commercial or open specification, and the honest and rational contractor suffers because of the bad faith of some of his competitors. Some contractors will beg an engineer to let them have specifications when he has them to give out, and yet the same contractors will go to an engineer's clients and endeavour to secure the work on their own specification, which contains such explanations of details as "large," "of ample size," "approved design," and similar vague and unmeaning terms.

It would be of much greater interest were it possible to write such a note as this with full particulars of the matters touched upon. This, however, is not practicable, and only more or less vague generalisations can be employed. Suffice it to say that the facts at the back of this are substantially as set down, and that it is not easy to put out an open specification unless the engineer has full choice of the firms to whom to send it. When tenders must be publicly advertised, the use of the open specification lays it open to the less scrupulous man to put in shoddy work on the lowest-tender basis. The almost compulsory acceptance of the lowest tender in municipal work is one of the worst features of modern municipal trading, yet it is very difficult to see a way out of the dilemma.

Water Economy and Electric Pumping.

Especially in London, the imposition of a water rate on City property on the basis of the rental, instead of on the consumption, often operates unfairly, and has resulted in a good deal of striving after private water supplies. Where a consumption of 1,000 to 10,000 gallons per day will cost only a few shillings to pump, it might cost hundreds of pounds per year if charged for by the Water Board.

Many private supplies have thus been installed with artesian wells and deep-well pumps electrically driven. Electricity at power rates lends itself particularly well to the work of pump driving, and a deep-well pump not too clumsily made will run for years efficiently at a low speed with very little wear.

Some years ago the air-lift pump was introduced. Its one advantage is that it will raise more water from a given well—if the water is there to be raised—than can be raised by an ordinary pump. But against this one advantage several disadvantages have to be set. First, it is necessary in London to bore a well deeper by 50 to 150 ft. than is necessary for water supply, in order that the air lift may work. Secondly, an air compressor is needed, and requires its full share of attention. Thirdly, unless even another 200 to 300 ft. of boring is added to the already excessive depth, the air lift cannot raise water to the roof tank, and a separate surface pump must be installed. Fourthly, the expenditure of power by an air-lift pump is from three to five times that necessary for an ordinary pump. This extravagance is carefully kept in the background when the air-lift pump is offered. Lastly, the copious impregnation of the water with oxygen is very detrimental to all the iron or steel with which it comes into touch. Oxygen has double the solubility of nitrogen, and the pressure in a London well at the extreme depth of submersion may be several atmospheres, and implies severe oxygenation and great destruction of parts On this detail alone the wear and tear of an air lift will very soon go far beyond the wear of a slow-running pump.

The extravagant use of power by the air-lift apparatus is very liable to convey a wrong impression of the cost of electrical driving. To begin with, the compression of air and its subsequent use for power generation is a very inefficient process; it may be justified in a mine, where the air which goes to waste is useful as a cooler of the atmosphere; but to use air to work a pump is one of the most inefficient methods of air utilisation. Users know nothing of the intermediate process of the pumping plant. They receive so much water and pay for so much electricity and compare the costs, and this gives an undeservedly bad name to electricity, which receives the blame for the inefficiency of the whole plant. A simple pumping plant with worm gear, direct driven from an electric motor, or a properly-designed double reduction gear, or a chain drive with a high-class chain, will run at a high efficiency, and show as cheap a power cost as a producer-gas engine, without the labour cost and the dirt, which may mean so much in a city building. There are justifiable uses for the air lift, and it may be employed in many instances where the water is not far from the surface, but the inefficiency increases with depth, and so also does the corroding influence of the oxygen-saturated air. A good deal of charlatanism has been connected with the sale of air lifts, especially in regard to the advocacy of particular ways of letting the air into the water at the base of the deeply submerged water-rising main. How air can be coaxed into a water pipe 400 to 500 ft. long in such a manner as to influence its behaviour in that length of main, is a proposition that no engineer is likely to consider seriously. Suffice it to say that while electric driving is a proved success in plain pumping work, it is liable to suffer in character if combined with the notorious inefficiency of the air-lift pump; and users should be careful lest they be dragged into the expense of this system of driving, when they may employ a simple electric drive at a proper and reasonable cost.

D

ARTISTIC STREET LAMP STANDARDS.

We have received the following letter from Mr. S. G. Rhodes, superintendent of the arc lamp department of the New York Edison Co.:—

"The Electrical Review of March 22nd, 1912, has an article devoted to the consideration of street lighting that is somewhat ambiguous, in that the article in question has to do with standards designed exclusively for special display lighting, limited in most cities to several squares in their main thoroughfares, and not as your editorial in the same issue might lead one to assume, to standards for municipal street lighting. The erroneous impression that might possibly obtain has induced me to take the liberty of addressing you relative to this detail of the street lighting equipment in the United States, without, however, discussing that phase of it considered by your article and editorial, except to say that they have suffered somewhat in reproduction, and that your contributor is correct in that this form of standard for "White Ways" has been very satisfactory to the merchants and municipalities where they have been installed.

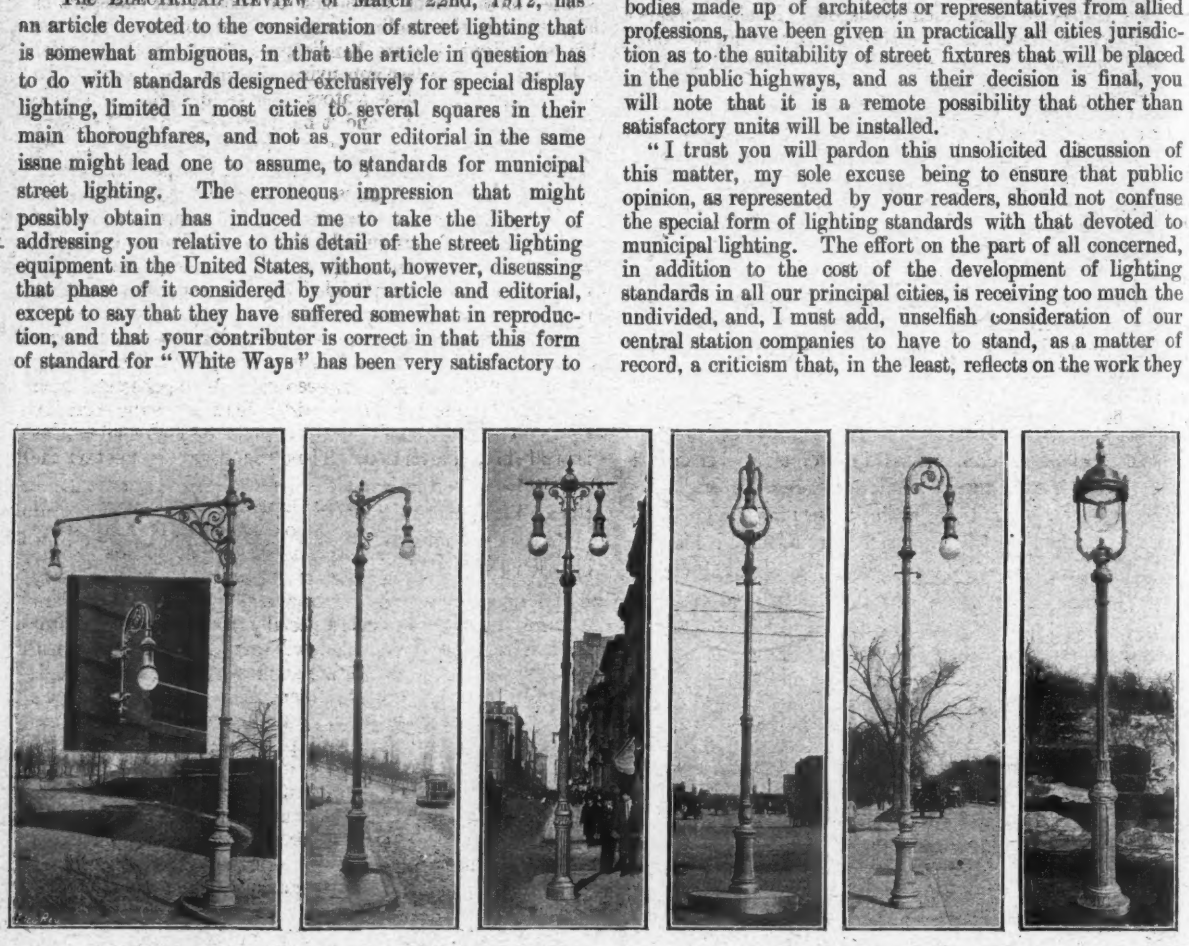
"The state of the art as it is reflected by the standards installed for the various municipalities throughout the country is on a very high plane, as will be appreciated when it is considered that the electricity supply companies have for the most part turned this work over to an architect, and, in collaboration with the electrical engineers of the company, designed the standards for the system to be used with consideration for the locality in which they are to be installed. To such an extent has this form of development proceeded, that our most prominent designers are retained by either the municipality or the electricity company, with the result that our broad avenues, boulevards, parked streets and open squares, as well as the usual city thoroughfares, are lighted by standards, which, from the æsthetic point of view, leave nothing to be desired, and in which also is considered the practical and efficient side of the lighting unit made part of the equipment. This detail of attention has become specially prominent in the design and treatment of standards for viaducts, bridges and other forms of public highways, and to the advantage of the artistic as well as the utilitarian side of the matter. Municipal Art Commissions, or similar bodies made up of architects or representatives from allied professions, have been given in practically all cities jurisdiction as to the suitability of street fixtures that will be placed in the public highways, and as their decision is final, you will note that it is a remote possibility that other than satisfactory units will be installed.

"I trust you will pardon this unsolicited discussion of this matter, my sole excuse being to ensure that public opinion, as represented by your readers, should not confuse the special form of lighting standards with that devoted to municipal lighting. The effort on the part of all concerned, in addition to the cost of the development of lighting standards in all our principal cities, is receiving too much the undivided, and, I must add, unselfish consideration of our central station companies to have to stand, as a matter of record, a criticism that, in the least, reflects on the work they are doing. The improvement of the public highways appeals to those having the civic advancement of their city in mind, and the lighting companies yield to none in this matter.

"It has occurred to me that a few photographs of some of the designs of standards in use by one company—the New York Edison Co., New York City—would serve to illustrate this point. You are at liberty to retain these photographs and to use them if you so desire. Permit me to express my appreciation in advance for your consideration of this communication.

"Samuel G. Rhodes,
"*Superintendent, Arc Lamp Department.*"

We have much pleasure in printing this courteous communication from Mr. Rhodes, and in expressing the opinion that the illustrations which we reproduce will give a very different impression from that left by the article to which he refers. The designs now shown are graceful and artistic, and bear witness to the care devoted to them by the authorities in New York. It will be noted that Mr. Rhodes refrains from discussing the merits of the designs which we felt called upon to criticise adversely, merely stating that the forms of standard in question have been very satisfactory to the people who use them; we infer from this that his associates were not responsible for them—an inference which is borne out by the general excellence of the designs here illustrated. In this country we have not as yet developed enthusiasm for "White Ways," and we are therefore compelled to have regard, first of all, to the utilitarian aspects of the subject.



(1 and 2) (3) (4) (5) (6) (7)

Examples of Street Lamp-posts; New York Edison Co.

1. Arc lamp-post; tubular steel mast and arm, with iron scrolls and ornamental castings; for use in wide thoroughfares or tree-lined roads.

2. (Inset.) Arc lamp-bracket for use where space is limited.

3. Arc lamp-post, tubular shaft and scroll bracket, standard pattern, for Manhattan and Bronx.

4. Arc lamp-post, twin suspension, used only in Fifth Avenue.

5. Arc lamp centre post with lyre suspension, for busy thoroughfares.

6. Arc lamp-post, bishop crook type, standard pattern, for Manhattan.

7. Tungsten lamp-post, for Central Park.

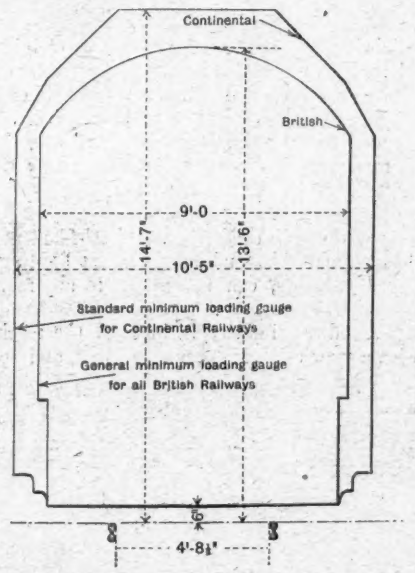
THE TRANSPORT OF MODERN LARGE UNITS OF MACHINERY.

BY ADOLF. R. STELLING, DIPL. ING.

WITH the growth of the demand for high power electric motors and generators there has arisen a difficult series of problems connected with their transport; it also appears that the cost of installing an extra-high-power unit is considerably increased by the difficulties encountered in the forwarding.

In the first place, the actual freight charges increase with the weight of the package. Take, for example, the freight of electrical machinery to South Africa; the charge per ocean ton from British port to Durban varies between 30s. per ton for packages weighing 10 cwt. or less and 90s. per ton for packages of 10 tons. This increased cost is largely due to the necessity of handling heavy consignments by special cranes or other lifting apparatus, but there are very few goods yards equipped with the tackle necessary for the handling of modern machinery.

When forwarding a 25,000-H.P. Parsons-Brown-Boveri turbo-alternator from the works at Le Bourget to the St. Denis (Paris) central station, it was found that three items, namely, the turbine rotor and the upper and lower halves of



the turbine casing, were too heavy to be handled by the cranes at the railway sidings near the power station, and therefore the journey of 5½ miles had to be made by road.

The dimensions of this set are:—

Overall length, 44 ft. 8 in.; overall width, 13 ft. 2 in.; length of turbine, 27 ft. 10 in.; length of alternator, 18 ft. 10 in.

The turbine rotor is 22 ft. 2 in. long and 10 ft. in diameter; it weighs 40 tons. The cradle in which it was conveyed weighed 3 tons and the lorry itself 12 tons; 35 horses were necessary for the haulage. The width of each of the four wheels being 12·2 in., the load on 1 in. periphery of the rear wheels was 6,800 lb. per sq. in.

On leaving the works, the branches of trees impeded the cavalcade; these being sawn off, no further check was received until, by mistake, a turning to the right instead of to the left was made. The services were then requisitioned of a salvage contractor, whose cart, with levers, balks, chains, jacks and winches, had accompanied the load. Their services were again in demand when the vehicle skidded and crushed the kerb. Four hours were occupied in jacking back to the centre of the road. The iron gratings of two ventilating shafts were crossed after covering them with ¾-in. boiler plate. One level crossing and two bridges were crossed without mishap, one of the bridges being a drawbridge over a canal, supported on this occasion by a structure built on the towing paths.

The complete journey was accomplished in 10 hours, and the damage done was confined to the crushing of 1,850 paving stones, sundry kerbs, and the cracking of one iron grating. No damage was done to the gas or water mains, and the total cost of the transport of the three items (the second and third journeys being made without incident) was between £400 and £450. A full account is published in the *Revue Industrielle*.

The most serious restriction of economical transport of large units is the loading gauge on the railway; here the British designer is more handicapped than his Continental colleague, as the accompanying diagram will show. To pass the loading gauge stators must be designed to divide into two or four parts, and it has even been found necessary to forward the rotors of large induction motors (for winding engines) in their component parts, *i.e.*, copper, stampings, bolts, &c., in separate cases, and the hub split in halves. One of the rotors in question had a finished diameter of 144 in., and was consigned by the British Westinghouse Co. to South Africa; on being taken into the interior the portions could only be unloaded with the help of a wrecking crane sent by the railway company.

The loading gauge can be exceeded if special arrangements are made with the railway company concerned, but this is often an expensive proceeding. A consignment such as a stator frame which is wider than the gauge can be forwarded overhanging the truck on the 6-ft. way-side; this means stopping all the traffic on the other line across the 6-ft. way.

For the transport of these large burdens special "well trucks" are designed giving a loading level of 2 ft. above the rails, and having a bogie at each end. These trucks are designed for well-lengths of 15 to 35 ft., and to carry weights up to 40 tons on the longest size; to convey modern electrical machinery, and especially large turbo-generator sets, trucks are required which will carry as much as 60 tons. The trucks, however, which are at present being constructed, are being designed with a well length of 35 ft. This seems too long to give satisfactory running results, as the great majority of the loads will be practically central loads for such a long truck. In view of modern practice and modern tendencies, well lengths of not more than 25 ft. seem more suitable. In support of this statement may be taken the example of the 25,000-H.P. set in which the maximum indivisible length is 22 ft. 2 in. Further, for "Lancashire" boilers 30 ft. in length, the standard boiler trucks can be used.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

THE Department of the Interior has recently created a water-power branch which will deal with the control, &c., of water-powers in Manitoba, Saskatchewan and Alberta. Engineers have already been set to work to investigate and report on the water-powers of the West.

The terminal of the Grand Trunk Pacific Railway, Prince Rupert, B.C., is likely to become an important centre in the near future as lumber mills, cement works, smelters, flour mills, &c., are to be erected, and heavy demands for power will probably be made on the Prince Rupert Hydro-Electric Co.

The Ottawa Light, Heat and Power Co. have recently decided to take what appears to be rather an extraordinary step in connection with an extension to their power plant. Although Ottawa occupies an almost unique position, even in Canada, for the economical development of hydro-electric power, the company referred to have decided to put in some 6,000 H.P. in the form of steam plant. It appears that the idea is to use this plant primarily to take peak loads, and, secondarily, to act as a stand-by, and the management of the company is of opinion that though, for continuous operation, water power is the cheaper, yet for intermittent loads steam power has the advantage.

A deputation of five Senators from New York State has recently been visiting a number of places in Ontario in order to secure information respecting the operations of the Hydro-Electric Power Commission of this province. The advisability of establishing a similar system in New York State is now under consideration by the legislature there, and a report on the subject is to be submitted at the next session of that body by the deputation referred to.

Application for power has been made to the H.E. Power Commission by representatives from the districts around the towns of Beaverton, Cannington, Sunderland, and other places lying about 50 miles north of Toronto, and the Commission's engineers will shortly investigate and report on the subject. It was stated that, if the Commission's system were extended in this direction, many farmers would use it.

Two applications have recently been made for power rights on the Rainy River, which is situated in the extreme west of Ontario, and which connects the Lake of the Woods with Rainy Lake, one by the Ontario and Minnesota Power Co. and the other by the Rainy River Improvement Co.; these are being investigated by engineers of the Public Works Department. As the Ontario Government is concerned in the matter, the question of a site for the necessary dam is to be considered by it, and as a question of water levels also comes in, the report drawn up by the engineers of the Public Works Department must go before the Canadian Section of the Waterways Commission.

The recent coal strike in England lends some interest to the statement that the municipal council of Calgary in Alberta favour the idea of municipal ownership and operation of a coal mine, coupled with the actual selling of the coal to residents at a reasonable price.

A report from Saskatoon states that 14,000 H.P. could be developed on the South Saskatchewan River and power delivered thence to the town referred to. The cost of the scheme, including transmission lines, would be about £440,000.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

An Objectionable Clause.

A propos of "Fairplay's" letter, headed "An Objectionable Clause," I certainly think all reputable electric wiring contractors should have nothing to do with a specification which contains a clause with such arbitrary powers. A contractor accepting work under these conditions would obviously lose money, as it is now general knowledge that no Union man is ever satisfied, therefore, like Oliver Twist, he is always "asking for more." I presume the Socialist Guardians have in view the curtailment of the contractor's right of authority. If so, I can congratulate them on inserting a stipulation which will rob the contractor of his say in the matter as to whom he shall employ and whom he shall dismiss, or, to be more precise, the Electrical Trades Union will be the authority, whilst the contractor will play second fiddle, he, at the same time, financing the work and taking the risk of bad work and tests.

Now the term Trade Union plainly means Socialism; I would suggest that all reference to the term Trade Union be deleted, and "local conditions and rate of pay," with schedules, be substituted; also any differences of opinion arising between the contractor and his employés should be settled instantly by the contractor dismissing the complaining workman.

Percy D. Collins.

Wimbledon, *June 10th*, 1912.

The Limerick Appointment.

This hardy annual is with us once again! You publish in your current issue a long advertisement inviting applications for the office of borough electrical engineer to this notorious borough.

As the writer happens to know something of the manner in which municipal matters are managed in this town, let me say that it is quite useless (fortunately) for English engineers to waste their ink, paper, stamps, and time, in applying for the position.

On three occasions within the past few years the position has been open for competition, and on two occasions selected candidates were required to sit for a technical examination. On each occasion English candidates came out at the top of the list. What was the result? Were they appointed? No! Why? Simply because Anglo-Saxons are not tolerated in this part of Ireland. The appointment went to men who were either able to sign their name in Gaelic, or to produce a birth certificate showing that they were born and reared in Ireland. A knowledge of engineering was quite a secondary consideration.

The job would be no sinecure if the salary offered were £1,000 per annum.

In the Know.

June 8th, 1912.

THE INDIRECT LIGHTING OF ROOMS.

BY "WHISTLEFIELD."

INDIRECT lighting by means of arc lamps and inverted shades has long been recognised as the best method of illuminating drawing offices and other places where even and shadowless lighting is desirable, but this method of lighting was not extended to the lighting of rooms, because, with the exception of arcs and Nernst lamps, it was hardly possible to get lamps of high enough efficiency and candle-power for the purpose.

The advent of the high candle-power metal-filament lamp, however, has altered this, and now indirect lighting, with all its many advantages, can be applied to any room that has a white ceiling.

Many of the indirect lighting fittings on the market are designed with a view to their decorative effect, and seem to

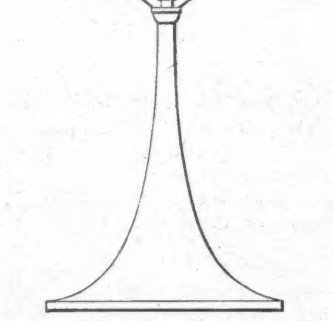


FIG. 1.

treat as of quite secondary consideration the main object of the fitting, which is to reflect as much light as possible, not only on to the ceiling, but all over the ceiling.

One of the finest reflectors for this purpose is the ordinary white opal shade, which is made in such standard sizes as 18 in. diameter by 6 in. deep, and 15 in. diameter by 4½ in. deep, and the following experiment, which is easily carried out, is well worth a trial in any room, such as a drawing-room, where inverted lighting could be advantageously applied.

Take any table or portable lamp and fix under its shade-carrier ring a 15-in. opal shade (see fig. 1); put a 50-C.P. metal lamp into the holder, switch on and hold this lamp over the head in the centre of the room so that all the light is thrown on to the ceiling; if every other light is

switched off, the room will be flooded with a soft white light, the beauty of which will hardly be credited unless seen. By moving the fitting nearer to or further from the ceiling a position will be found where the whole of the ceiling will be evenly illuminated, and the general lighting effect will be at its best.

Fig. 2 shows a very simple fitting, consisting of a 15-in. diameter × 5-in. deep cardboard conical shade, suspended below a plain pendant. It is quite clear from the diagram

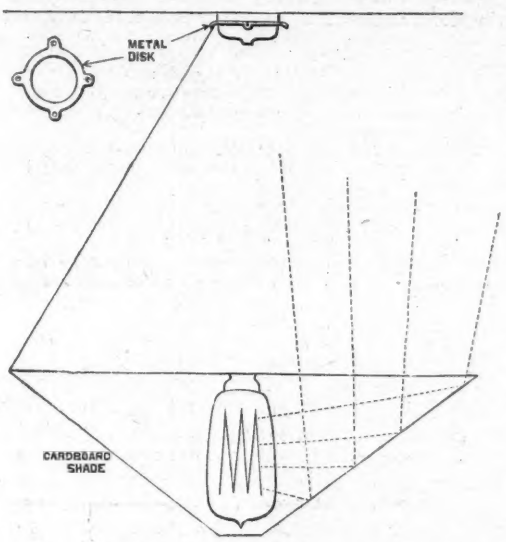


FIG. 2.

that practically all the light given off by the lamp is reflected upwards and outwards, thus illuminating a large area of ceiling. This fitting while being quite serviceable as a reflector is not sufficiently decorative for a room, and fig. 3 shows the same kind of arrangement, only in this case the shade is of opal and is fitted with a metal band carrying a fringe of beadwork or silk; the opal shade rests on the lip of the

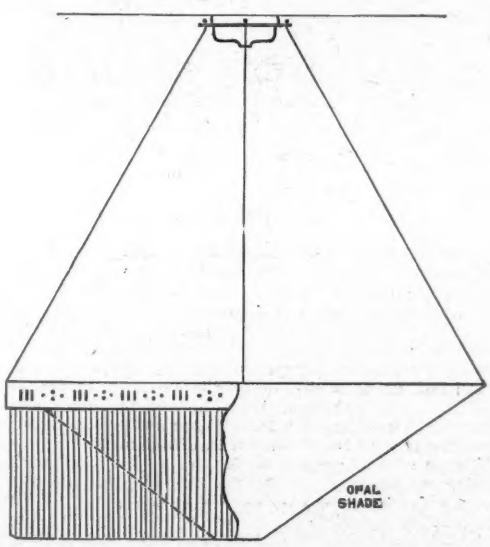


FIG. 3.

band, and the whole fitting is suspended by means of cords attached to this band.

Fig. 4 shows a wire frame which any electrician can readily make up with stout birdcage wire of such a size that a 15-in. diameter × 4½-in. opal shade, if it is to be used with a 50-C.P. or 80-C.P. lamp, or 18-in. diameter × 6-in. deep shade if a 100-C.P. lamp, will just fit into the tapered part as shown. The taste and ingenuity of the ladies of the household, aided by scraps of silk, will convert the wire frame into a thing of beauty, figs. 5 and 6 affording a mere indication of what is possible in that direction; it will be found that white is the best colour for the groundwork, and as a fair amount of light filters through this background, it lends itself to decorative work.

The cords by which the shade is hung may be either silk or ribbon, while strings of beads are very effective in cases

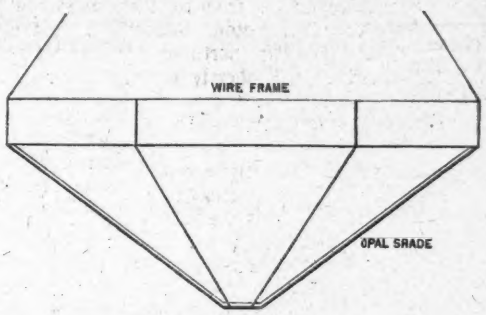


FIG. 4.

where bead fringes have entered into the scheme of shade decoration.

Before leaving the subject, it may be well to add a few notes regarding efficiency in this method of lighting. It is not efficient to put a group of lamps inside an inverted shade, and there is no reason for doing it; lamps can be obtained of practically any candle-power, and certainly a

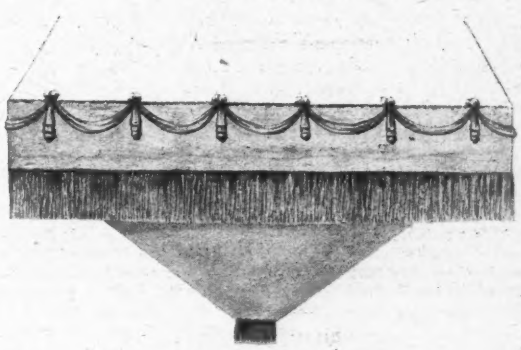


FIG. 5.

100-C.P. lamp gives as much light as can possibly be required from a single fitting. It must be remembered that metal-filament lamps, from the very nature of their construction, shed most of their light in a horizontal direction, and a conical shade, such as that shown in fig. 2, will reflect up the maximum quantity of light from the lamp,

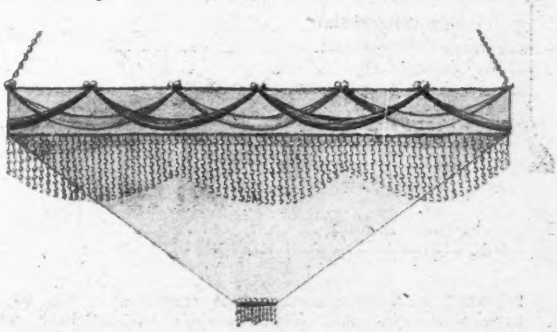


FIG. 6.

but if a group of three or four lamps hanging at an angle be placed in a bowl fitting, as is the case in a large number of fittings on the market, it is impossible to design a reflector which will not send a good deal of light back into the lamps and holders, and a loss of efficiency will be the result. On the ground of first cost as well as running cost, the single lamp easily holds its own, and the only point not in its favour is the fact that when a lamp fails all the light is out; but

that factor is not worth taking into account in most cases, compared with the gain in efficiency.

The human eye readily adjusts itself to the intensity of the illumination that it has to endure, and anyone stepping from bright sunlight into a room well knows that it takes some minutes for the eye to be adjusted to the lower scale of intensity, but when this has taken place it is quite as easy to see clearly in the room as in the sunlight. This fact explains why it is that indirect illumination appears so bright compared with direct lighting where the same candle-power of light has been used.

In indirect lighting the illumination is practically even, and there are no bright points for which the eye has to be adjusted, so that the iris is open to a larger extent than would be the case were bright lamps dotted about as in direct lighting; thus the eye can see more clearly with less light than is the case with badly-arranged direct lighting. The cases are comparable to a man sitting in a room and another who is continually stepping out into the sunlight. The latter thinks the room dark, and the former sees quite clearly, simply because the eyes are differently adjusted; and as this adjustment is quite automatic and beyond our control, and the eye is always adjusted for the strongest light that it is called upon to endure at the time, the problem of the lighting engineer is to arrange his lamps so that there are no bright lights visible, and all the illumination is as far as possible even. Indirect lighting by means of inverted shades is the only solution, so far, to this problem in the lighting of rooms, and the restfulness of this light on the eyes, and, therefore, on the whole system, is well worth the trouble of making up a few fittings as described above.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Simplex Heating Apparatus.

Messrs. Simplex Conduits, Ltd., London and Birmingham, are introducing a series of boiling plates, which are of very solid mechanical construction, and in which no material is used which is likely to be detrimentally affected by the high temperature at which these plates are required to work. They are made in three sizes—6 in., 8 in. and 10 in. diameter—and these sizes may be obtained arranged for temperature regulation, either by means of the usual three-pin terminal, which gives four variations from one quarter to full heat, or when required for use on circuits not under

Fig. 1.—Simplex Heater in Cast-brass, Gilt-finish for Ships' Saloons.

Fig. 2.—Simplex Cast-iron Boiling Plate with Heat-regulating Switch.

200 volts, with a special three-heat regulating switch, which is attached to an extension piece at the side of the plate in the manner shown in fig. 2. This heat switch is fitted with an indicating dial, which clearly shows the exact regulation which is being worked to.

A number of Simplex heaters have recently been supplied for ships' use, and these are, of course, of special design and construction. A typical pattern shown in the firm's new catalogue, to which we refer elsewhere, is that appearing in fig. 1. It is very heavily constructed in brass and gilt finished, and affords an excellent example of the work of the company's artistic metal and fittings department.

Belling's Electric Geysers.

Mr. C. R. Belling, of Enfield, Middlesex, has applied for patents on an electric geyser consisting of a heating element of resistance ribbon, each side of which is kept in perfect insulated contact with one face of the metallic body part of the geyser, the other face of which consists of a number of webs or radiating fins, so arranged as to give the water to be heated a long tortuous passage, thus causing it to impinge on the webs and immediately absorb the heat generated by the element. With this system a maximum heating with a minimum cooling surface is obtained. The geysers are being constructed in two patterns, namely, the "Spiral" and the "Maze" type. In the "Spiral" pattern (fig. 3) the element is in two parts, one wound on the central delivery tube, and one on the main body. The whole is enclosed in a water jacket through which the supply enters at the top; it passes thence to the bottom of the spiral waterway, rises through this (at the same time finding its level in the water jacket), and is finally delivered to the top of the central tube, the lower end of which forms the outlet. The geyser is, therefore, always full. The jacket has an air valve to prevent air locks. Tests taken with this pattern show that a continuous delivery of hot water is obtained at the rate of one gallon per minute, raised from 15° C. to 39·5° C. with an efficiency of 95·8 per cent. The water reaches this temperature 1½ minutes after switching on, and the flow is then continuous. This type must be used in the vertical position.

The "Maze" Pattern, fig. 4, is of simpler construction, and is the standard line. Having no cold water jacket, its efficiency is slightly lower than that of the "Spiral" pattern, but it has several compensating advantages. The heating element is securely clamped between the two inner insulated faces of the body of the geyser, and is completely surrounded by water (as will be seen from the sectional view). Owing to the perfect contact obtained, the conduction of the heat to the water is almost instantaneous, thus the

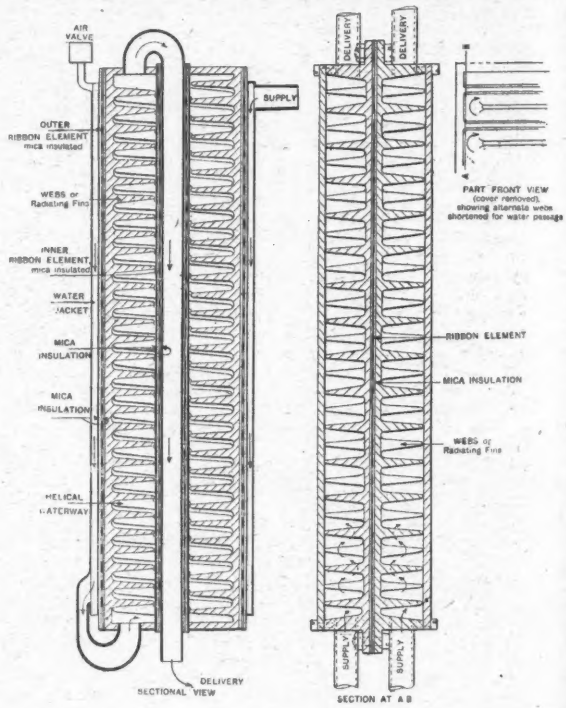


Fig. 3. Fig. 4.

Electric Geysers.

temperature of the element itself can never rise much above the temperature of boiling water, under which conditions its life is practically unlimited. With this pattern the water passes through both mazes in parallel, thus eliminating all air valves and other accessories. This type will also stand any pressure up to 160 lb. per sq. in., and can, therefore, be fitted in connection with any existing hot-water supply system, enabling the water to be heated by the coal fire normally, or by the geyser when the fire is not available. Any desired quantity of hot water at any specified temperature can be arranged for by fitting a multiple geyser built up of a number of the "Maze" pattern units in parallel.

The use of these geysers, in addition to the excellent lighting, heating and cooking apparatus already on the market entirely dispenses with the necessity for gas or coal in any house. With electricity at 1d. per unit, a hot bath of 15 gallons, at the temperature of 100° F. can be obtained in 15 minutes at a cost of a fraction over 2d. There is only one control handle, which gives cold, hot or boiling water at will.

It is claimed that the control is quite foolproof; there is only one handle to operate, and this is arranged at the right-hand side of the case, keeping the over-all projection of the apparatus from the wall down to 5 in. The operating handle is actually the water tap handle, to which the electric switch is mechanically connected inside the case, it being impossible to switch on the current before the water, or to turn off the water without first switching off the current.

Each pattern is supplied complete with specially designed control gear, and the whole is enclosed in one case, the over-all dimensions of which are 16 in. × 16 in. × 5 in. The gear consists of a screw-down water tap and union; double-pole independent quick make-and-break switch, breaking at four points; double-pole fuses, and terminals for fixing main supply.

An additional safeguard is provided against the possibility of the main water supply failing whilst the geyser is left working unattended to. This consists of a special fuse in the body of the geyser, which melts at a pre-determined temperature, and so breaks the electrical circuit, preventing any damage to the apparatus.

The whole apparatus is made throughout with metal, mica and porcelain, and there is no inflammable material whatever in its construction.

LEGAL.

DIESEL ENGINE CO., LTD., *v.* CRITTALL MANUFACTURING CO., LTD.

IN the King's Bench Division on June 6th the Lord Chief Justice and a special jury had this action before them.

Mr. Holman Gregory, K.C., and Mr. W. Allen were for plaintiffs; Mr. Montague Shearman, K.C., and Mr. R. F. Colam for defendants.

MR. GREGORY said the claim was for £1,129 10s., being 50 per cent. of the purchase price of a 225-B.H.P. Diesel engine and dynamo and accessories, this being the first instalment due. The contract to purchase the engine was in writing between the parties, the Crittall Manufacturing Co. having agreed to pay in all £2,259 for the engine, and it was part of the bargain that half the amount should be paid on completion, 25 per cent. when the engine was running, and 25 per cent. three months afterwards. The engine had been delivered, and the plaintiffs were now asking for their money. In the year 1910, said counsel, the plaintiff company were the owners of the Diesel patents. They were not manufacturers of engines, but entered into contracts with different firms to manufacture the engines. The plaintiffs, in fact, bought engines of different power made by different manufacturers under their licence. In this way plaintiffs obtained engines from Messrs. Carels Frères, of Ghent, as well as from Messrs. Willans & Robinson, of Rugby. One of those obtained from the latter firm, and numbered "23," was the one dispatched to the defendants' works at Braintree, in Essex. On March 23rd, 1911, the defendants were apparently anxious to acquire a Diesel engine for the purpose of running a dynamo for general electric lighting and power, and negotiations took place with the result that on July 11th, 1911, a contract in writing was entered into. The terms were accepted, and following that contract, the plaintiffs, having delivered one of the Willans & Robinson engines to the defendants, asked for the payment of the 50 per cent., and then the defendants raised several difficulties. The defence was first of all that the plaintiffs had not delivered a complete machine, but, as a fact, the machine had not only been delivered, but had been erected, and was now in running order. The defendants said the plaintiffs had tendered parts of a Willans engine, which was a different engine to that contracted for, but, said counsel, a Diesel was a Diesel, whoever it was manufactured by, and it was made upon the Diesel patents. Another defence was that the contract was to supply an engine which would give 195 revolutions a minute, whereas that supplied by plaintiffs gave only 180 revolutions a minute. As a matter of fact, the engine supplied by Willans was of 200 H.P. at 180 revolutions per minute, but it could safely run at 195 revolutions a minute, developing 225 H.P. This engine, of which the defendants complained, was properly constructed, and provided the power specified in the terms of the contract. The sister engine had been running for months at 195 revolutions a minute and developing 225 H.P., to the satisfaction of everybody concerned. Another of the defences was that the engine tendered was not one of the best quality construction as contracted for, but "one of a batch of engines which, to the knowledge of plaintiffs, were defective and inferior in construction, and which they themselves had advertised in the ELECTRICAL REVIEW of February 3rd, 1911, for sale on the terms that no reasonable offer would be refused for them." As a matter of fact, said counsel, it was not one of these engines that was supplied to defendants. It was part of the plaintiffs' contract with Willans & Robinson that before the defendants took over the engine they should have a running test, and that the engine should pass the test. An expert was sent down by the plaintiffs, and he found one or two minor faults, and they were put right by Willans and Robinson, and the engine was passed. Then they said this was one of the engines advertised in the ELECTRICAL REVIEW, but it was not. The plaintiffs had entered into a contract with Willans & Robinson to make more machines than they found they could sell, and, anticipating that the patents would soon run out, the advertisement was inserted. When persons did apply they were, in fact, asked a higher price than the defendants contracted for. Defendants said they were shown a Carels engine at the Hoffman Manufacturing Co.'s works at Chelmsford, and were promised one like that, which was denied, and defendants, by taking away two little bits from the remainder of plaintiffs' letters, alleged fraud. Counsel submitted that the defendants had either to accept or reject the engine, and the correspondence clearly showed that they accepted it. Their only claim could be one for damages for breach of contract, inasmuch as the engine supplied was not the engine they contracted to send, and there was not a word of such a claim in the counterclaim.

MR. WILLIAM BATHO, managing director of the Diesel Co., said his company did not manufacture engines, but granted licences to manufacturers under their patents while they lasted. One of these firms was Willans & Robinson, who also manufactured engines for the plaintiffs. The specification sent in reply to defendants' inquiry was in the usual form.

His LORDSHIP: That describes it as "one Diesel engine."—WITNESS said it was the usual printed form sent out generally. At the interview in June, 1911, with Mr. Crawter (of the Crittall Co.), when the matter was discussed, there was no mention of a "Carels" or any other make. Carels did not make an engine of that size. Witness told Mr. Crawter he could take him to see several of the Diesel engines running, but he never sent defendant to examine that working at Chelmsford.

Cross-examined by MR. SHEARMAN, WITNESS said many hundreds of these engines had been installed in England. Speaking roughly, about a quarter of these were "Carels," and a good many were by Sulzer.

Have the Carels engines been remarkably successful, and have they a high reputation?—Yes. Witness said they gave a trial order for a dozen machines to Willans & Robinson, and they also agreed to take 100 cylinders, this contract afterwards being rescinded by agreement.

Was this because they were extremely unsatisfactory?—No.

Did you insert this advertisement in the ELECTRICAL REVIEW:—"To clear: Several Willans-Diesel oil engines, that have only been run on the testing bed. No reasonable offer refused. For full particulars, apply Diesel Engine Co., Ltd., 179, Queen Victoria Street, London, E.C." Did you put that advertisement in to get rid of this lot cheap?—No.

How many of these engines did you have on hand when you offered them for sale?—We had at that date, I think, six. They were at Rugby.

How many have you sold in England since the date of that advertisement?—None.

Is it a fact that nobody will look at a Willans-Diesel engine?—No. There is no such thing as a Willans-Diesel engine. WITNESS said it was not true that the demand for Carels engines was so great that they could not get delivery under eight months. He could deliver a Carels 200-H.P. engine within six or seven weeks.

Did you sell any of those you advertised in the ELECTRICAL REVIEW?—No.

Is not the Willans & Robinson engine notorious?—No.

MR. SHEARMAN (holding up the page advertisement in the ELECTRICAL REVIEW): Would not an advertisement like that serve to spoil the market?—No.

On the 7th inst. MR. BRANCH, assistant engineer, gave evidence.

MR. FERGUSON, engineer for Messrs. Willans & Robinson, spoke as to the efficiency of the engines, which were made to the drawings supplied by the Diesel company.

In cross-examination, WITNESS said that on February 3rd, 1911, his firm had at Rugby three sister engines to that supplied to the Crittall Co. He saw the advertisement in the ELECTRICAL REVIEW at that time, saying that no reasonable offer would be refused.

Were Willans & Robinson annoyed about it?—That was the Diesel company's business. Witness added that his company were still manufacturing Diesel engines, and had a large number on order now.

Evidence was also called as to the satisfactory working of Diesel engines, made by Willans & Robinson, at the First Garden City at Letchworth; at the Uralite Co.'s works; and at the Suffolk Electricity Co.'s works at Felixstowe.

MR. CHARLES FREDERICK BENNETT, manager of the works for Messrs. Willans & Robinson, said that the engines they supplied to Letchworth, the Uralite Co., the Suffolk Electricity Co., and the Crittall Co. were identical.

MR. SHEARMAN, opening the defence, said he would prove that the order for this engine was given and accepted at an interview on July 4th. The plaintiffs took the order on the understanding that they were to supply a Carels engine, and with the intention of supplying a Willans engine. The Willans engine, said Counsel, was known to the public to be a doubtful engine—an engine which was known to create trouble. The Carels engine was known throughout the world as a good engine. The defendants ordered a Carels engine, and they were supplied with a Willans. The defendants gave an order for a 225-B.H.P. engine, and they were supplied with a 200-B.H.P. engine, and this engine was sent up to London from Rugby as a 200-B.H.P., stopped there and sent on to defendants as a 250-B.H.P. engine.

MR. CRITTALL, of the defendant company, said the contract was really made in his office, between himself and Mr. Branch, of the plaintiff company, at an interview on July 4th. The contract was for a Carels engine. Witness went to the works one morning and found that a Willans engine had come in. He then gave his instructions to Mr. Crawter. Witness was always willing to accept a Willans engine, subject to satisfactory guarantees as to its running. The engine was at the works, but had never been running, and the company had hired another at a cost of about £38 a week.

His LORDSHIP said he was going to rule that the defendants' remedy would be in damages. They had the engine erected, and did not reject it.

WITNESS said that his company did not use the engine, because the plaintiffs took away the material parts—the atomisers—so that they could not use it.

Cross-examined: The contract was for a Diesel engine and spare parts, cooling apparatus, and dynamo. That contract was made by Mr. Branch and himself in his office. The price, £2,259, was afterwards arranged by Mr. Crawter. He did not know that the Diesel company supplied any other than the Carels engine.

MR. SHEARMAN intimated that he was not going to persist in the charge of fraud.

His LORDSHIP: I am very glad to hear that.

When the case was called on Saturday, the LORD CHIEF JUSTICE

said he had read the correspondence, and had come to the conclusion that on the documents, neither party had stood on their strict legal rights. He had very grave doubts whether the defendants could raise the question as to the power of the engine.

MR. SHEARMAN said he was not there to say that the engine would not develop 225 B H.P., with 195 revolutions. His point was whether they could call the engine supplied a 225-H.P. engine.

His LORDSHIP remarked that the Diesel Co. said that there were three sister engines to that supplied to the Crittall Co., all running satisfactorily at that speed. After Mr. Crittall's evidence on the previous day, in which he undertook the responsibility, he (his Lordship) could understand that he had taken a hasty view of the position.

MR. WM. CRAWTER was called and sworn, and on the suggestion of the Lord Chief Justice, counsel had a consultation.

On returning to Court,

MR. SHEARMAN said his Lordship and the jury would not be further troubled with the case. There had no doubt been a genuine dispute between the parties, but the defendants were now thoroughly satisfied that there was no fraud on the part of the plaintiffs. Mr. Gregory appeared to be under the impression that he (Mr. Shearman) had used words which might be construed into an imputation on the engines manufactured by Messrs. Willans & Robinson. If he had by any error or slip of the tongue used words which conveyed that impression, he wished it to be understood that he had no such intention. It was now agreed that the document of July 11th constituted the contract, and the plaintiffs had agreed to provide a competent man for one year, to be the servant of the defendants. The defendants would pay the full contract price at once—that was 14 days after the passing of the test. The test was to take place before an engineer, to be approved by both parties, and if they could not agree, then an engineer should be appointed by the President of the Institution of Electrical Engineers.

MR. HOLMAN GREGORY, for the plaintiffs, agreed.

The LORD CHIEF JUSTICE said that in his opinion the settlement arrived at was a credit to both parties. He (his Lordship) had not the slightest doubt that Mr. Crittall did think he was going to get a Carels engine, because he thought that all Diesel engines were Carels engines. This was the sort of dispute which drifted on, and it was not until they got the whole facts out that they could come to a decision. His Lordship remarked that he had an interest in, and considerable knowledge of, Willans & Robinson's works, and had they been materially affected, of course he could not have tried the case. He thought this was a very satisfactory settlement to both parties.

CAPEL *v.* DUDLEY.

IN the Shoreditch County Court, on Friday, before his Honour Judge Smyly, K.C., Messrs. Capel & Co., of 168, Dalston Lane, Dalston, engineers, sued W. W. Dudley, of High Road, New Southgate, Middlesex, the proprietor of the Coronation Picture Palace, to recover £15 15s. 2d., the balance due for the supplying and fixing of a suction gas engine. There was a counterclaim for £9 9s. Mr. H. C. Davenport was counsel for the plaintiffs, and Mr. Godwin for the defendant. The plaintiffs' case was that they were asked to provide a suction-gas engine to provide the electric power for the operating room of the picture palace, which they did for £210. The amount claimed was the balance due. When the engine was fixed it was a success, and although there was a trivial fault or so, it was put right. The defence of Mr. Dudley was that the engine never worked satisfactorily, and accordingly on quite a number of occasions they were unable to open the picture palace, whilst on two or three other occasions the engine broke down and the electric light failed in the middle of the performance, and people had to have their money returned. He was recommended to go to Capel's by an electrical engineer, who said they were noted for the gas engines they supplied for picture palace work. The one he had was a Crypto. When he ordered it, it was on a guarantee that the gas engine should be in every way satisfactory, but it never had been, although at times it would go fairly well. Many times the engine "raced," and had to be shut off. The price originally agreed was £207, and he never agreed to £210. He heard subsequently that the dynamo they had intended to supply was not forthcoming, so, on the recommendation of a friend, he agreed to take another, but it was on the understanding that it was to cost no more. His counterclaim consisted of the loss he had sustained through being unable to open for business, and the expense he was put to in putting the gas engine right. The engine was fitted by plaintiffs' own men, and they stayed a fortnight to try and put matters right. Weights were put on the governors to make them work, and he complained of that, as he said not only had he never seen such a thing on a gas engine before, but it made a new engine look very unsightly. It looked just like a second-hand engine, and made a great noise, but he was told it would be all right after it had run for a little while. After the plaintiffs' engineer had gone, it stopped, and he at once 'phoned for it to be put right, but nobody came except once, and then they did nothing. It was true he had been asked for money on a number of occasions, but he declined, because he considered the guarantee to supply a good running gas engine had not been carried out. He told them on the 'phone that the engine was really no good, and they replied "send along the money and we will see after it," but he could not see the force of that. He promised to pay as soon as the engine was in proper running order. He had been called a fool to part with anything at all.

MR. PUDDICK, the engineer employed by the defendent, said he had a life-long experience of steam engines, but this was the first gas engine he had controlled, although he understood the running. When the pictures stopped, the engine raced. He might be called inexperienced, and had no idea of mixing gas, but he followed out instructions given by the plaintiffs' engineer.

MR. PERCY WM. DAVIES expressed the opinion that the engine was all right, but was carelessly fitted.

MR. DAVENPORT: We have nothing to do with that.

JUDGE SMYLY: Oh, indeed yes. An engine cannot run unless it is properly fitted.

MR. CHADDERTON, of Barking Road, Canning Town, who stated that he had had a great deal to do with combustion engines, said he found a quantity of wood-wool on the spindle, which had caused the engine to run wrong. He thought it had got there in the packing. The action of the spindle had caused the stuff to turn into a hard wad. It was certainly a remarkable thing that it had never been discovered all these months, but still the fact remained.

After hearing further evidence, JUDGE SMYLY found for the plaintiffs on the claim and counterclaim.

REDUCTION OF CAPITAL.

IN the Chancery Division on Wednesday, June 5th, Mr. Justice Swinfen Eady had again before him the petition of Edward Foster and Son, Ltd., brassfounders and electrical engineers, of Halifax, to confirm a special resolution to reduce the company's capital by £14,665, by cancelling 1,981 of the vendor's ordinary £5 shares—£9 905—and 952 of his preference £5 shares, viz., £4,760, making £14,665. The capital of the company was originally £50,000 in 5,000 £5 preference, and 5,000 £5 ordinary shares; 1,000 of the former and 2,000 ordinary were issued as fully paid to Mr. Foster, the vendor. The petition was adjourned from May 21st for the production of the balance-sheets.

MR. RUSSELL, K.C., for the company, said the loss would be borne by one person only, viz., Mr. Foster, the chairman of the company and its vendor. At one time in the company's existence, Mr. Foster agreed to postpone certain of his preference shares, and to put them in the same position as ordinary shares, and they appeared in the balance-sheet as deferred ordinary and preference shares, which, in fact, they were not. The petition had been amended, but since that was done, certain inaccuracies had been discovered and a reamendment was necessary. The amount of the loss £14,660 had been ascertained by a revaluation of the assets. The agreement by which Mr. Foster deferred the shares had been cancelled, and it was in order to restore this position with regard to 953 such shares that Mr. Foster had entered into an agreement under which 653 of his preference shares would rank as ordinary shares. It would have been simpler to have provided for a large number of preference shares to be cancelled, leaving a larger number of ordinary shares untouched.

His LORDSHIP sanctioned the scheme.

THE NATIONAL TELEPHONE PURCHASE.

THE Railway and Canal Commission, consisting of Mr. Justice Lawrence, the Hon. Gathorne Hardy and Sir James Woodhouse, sat in the King's Bench Division to-day to commence the arbitration proceedings between the National Telephone Co. and his Majesty's Postmaster-General to decide claims by the company arising out of the purchase of their system by the Government. Some 20 millions of money are involved, and the proceedings are expected to last many weeks.

The counsel engaged in the case were:—For the Telephone Co., Sir Alfred Cripps, K.C., M.P., Mr. W. O. Danckwerts, K.C., Mr. Forbes Lankester, K.C., Mr. E. Morten, K.C., Mr. H. H. Gaine and Mr. Aubrey T. Lawrence.

For the Postmaster-General:—Sir Rufus Isaacs, K.C. (Attorney-General), Sir J. Simon, K.C. (Solicitor-General), Mr. Buckmaster, K.C., Mr. Rowlatt and Mr. Branson.

In opening the case for the National Telephone Co., SIR A. CRIPPS said the company's claim exceeded in the aggregate £20,000,000, which was probably one of the largest claims in one case ever before the Courts. There was a great mass of detail to be gone into. Proceeding with the history of the matter, Sir Alfred said the career of the telephone in this country dated back to 1876, when Graham Bell's invention was put on the market. In 1877 and 1878 there were further well-known patents by Mr. Edison. He believed that in those early days the patents were offered to the Post Office, but that department refused to take them up. The next step was the case of the Attorney-General *v.* the Edison Co., of London, which decided that telephones came within the telegraph monopoly. Negotiations then took place, and, as a result, the first of a series of agreements was entered into in 1881 under which the various licences were granted by the Postmaster-General, and although dated as of that year, the licence to the Telephone Co. was not granted until 1884. That licence was for a duration of 30 years. It expired on December 31st, 1911, and as a consequence of its expiry the present arbitration came before the Commissioners. Under the 1884 agreement the Postmaster-General and the State received a royalty of 10 per cent., which had amounted in the course of the term to some £3,810 000. In 1905 a further agreement was entered into which contained the purchase clause with which the Court had to deal. Between 1881 and 1892 the National Telephone service absorbed all other licences from the Postmaster-General, and thus became themselves the sole telephone undertaking, with the exception that at that time, in small exceptional instances, the Postmaster-General's department was carrying on a telephone business. In 1894 the net income of the National Telephone Co. was £279,000, whilst at the end of 1911 it had increased to £1,229,000. The gross

income had increased during that period from £738,000 to £3,685,000. When the business was taken over by the Postmaster-General at the end of last year there were about 18,000 employés in the company's service, and that number would have undoubtedly been largely increased had the company been dealing with the concern as a business which they were going to carry on for all time. Going back again to the history of the matter, Sir Alfred said that about 1899 or 1900 difficulty arose, particularly in London, in regard to the laying down of conduits for the purpose of constructing an underground telephone system. The London County Council refused to grant to the company the necessary assent to their laying their wires in underground conduits. This action by the L.C.C. resulted, undoubtedly, in the construction of a very much larger amount of overhead system in London than would otherwise have been the case. In 1901 came the London agreement under which the Postmaster-General decided to compete with the company in the London area. This agreement contained a provision for the rental of underground wires from the Postmaster-General by the company. In 1904-5 negotiations were entered into which led up to the purchase agreement of 1905. The company's expenditure on capital account—and this did not include a very large sum paid out of revenue which would properly have been chargeable to capital account—amounted to £16,519,772. The heads of claim before the Court were, first, the licence business under agreement of 1884; secondly, what was known as the private wire business; thirdly, the fire alarm business; and fourthly, the electrophone business. In regard to the two last-named, the question arose whether they were properly to be included within the ambit of the valuation. The principle upon which the Court would have to proceed was that the valuation must be made on what were known as "tramway terms." Under those terms the principle laid down was that they must consider not what the rental value or scrap value of the plant was, but what was the value of the plant, stores, furniture, &c., *in situ*, ready for use by the incoming purchaser.

MR. JUSTICE LAWRENCE: Is no allowance to be made in respect of depreciation?

SIR A. CRIPPS: Oh, yes; certainly. I shall have to deal with the question of depreciation. We do not ask for what I may call "value as new" for depreciated plant.

Continuing, COUNSEL proceeded to deal at length with the various agreements, and said that Clause 2 of the 1905 agreement defined the subject matter with which the Court had to deal. It stated that, subject to the provisions of the agreement, the Postmaster-General should buy and the company should sell and convey on December 31st, 1911, all plant and buildings of the company in use or in process of being brought into use on February 2nd, 1905, the date of the agreement; in the case of plant acquired after the date of the agreement, the sale should consist of plant erected in accordance with certain specifications attached to the agreement, and thirdly, of land and buildings acquired or erected after the date of the agreement which had received the sanction of the Postmaster-General. The Court would thus see that the agreement provided an actual definition of the subject matter for sale, and here the word "suitable" under the tramway terms did not come into the matter at all. Referring to the inventory of the items to be valued, Sir Alfred said it involved many millions of items and had been made jointly between the parties and signed by them. In the result, for every £100 worth of articles to be valued, according to the company, the Postmaster-General excluded 5s. worth. His contention was that there must be some enhancing of the tramway terms in this case, viz., the addition of some small percentage. The question at issue was what was to be excluded as "spare," and "not in use" on December 31st, 1911. As regarded the efficient service, the company had performed all the duties thrown upon it in this respect.

Going into details, SIR ALFRED said the actual claim was for £20,924,700, and they had included all the plant they said was purchaseable under the 1905 agreement. The miles of circuit, or pairs of wires, amounted to 411,919. They valued this at £3,377,355. Then there was the equipment to be considered in 1,500 exchanges. These things came under one head, which totalled £19,821,458. An amount, however, was allowed for depreciation, which reduced that figure to £17,379,196. Commenting on a sum of £7,592 for printing plant, machinery, &c., counsel said that was an agreed amount. There would be no difference of opinion on the percentage of deduction to be allowed. The main fight would be as to the items on which depreciation would be allowed out of a total of items amounting to 17 millions of the claims. With regard to the claim for buildings, the company expected to have about 80 claims for compensation from all parts of the country, and there was a negotiation on which they hoped to come to an arrangement with the Postmaster-General for ascertaining the proper cost to be taken, either as the amount to be paid, or as a basis for the amount. There had been depreciation in town properties, and he would suggest to the other side whether it would not be a satisfactory basis to start on the ascertained figures, and take the real cost to the company of the properties. As regarded Portsmouth and Brighton the licences did not expire until 1926. With regard to Hull a rather peculiar position had arisen. The telephonic system there was carried on by the local authority and their licence expired on December 31st, 1911, the same time as that of the National Telephone Co. The Hull local authority, however, were still carrying on the telephone system, and the National Telephone Co. were told that they were doing so as agents for the Postmaster-General on a continuing licence for one year. The company knew of no power or right of the Postmaster-General to employ a Corporation or body as agents for that purpose. If there was such a right in the case of the Hull Corporation then the National Telephone Co. also had a right to be granted a continuing licence for a year and in respect of this they claimed £11,699. The figures in their total claim were based on estimates of the cost to the company, plus the contractor's profit, which undoubtedly was the best basis to proceed upon. After dealing with a mass of figures and tables showing how the company worked out the depreciation, &c., of plant, Sir Alfred said he had finished his remarks in opening.

MR. FRANK GILL was then called, and said he was appointed Engineer-in-Chief of the National Telephone Co. in 1902, and remained with the company in that capacity until the undertaking was acquired by the Postmaster-General. During his term of office 300,000 new stations were added to the company's system, and he was concerned in the construction of 570 new exchanges. Witness described the method in which the inventory was taken, and said that in minor matters both sides were able to agree with a view of saving labour. For instance, on every telephone pole there was what was known as the earth wire. They felt that it would be silly to count the number of staples fixing that wire to the poles, so the number on each pole was agreed to and reckoned in with the value of the pole. The insulators on the bare wires were dealt with in much the same way. Both sides agreed after checking a certain amount of such wires that there were 29 insulators per mile of wire, and they were reckoned up on that basis of calculation. Witness stated that the taking of the inventory cost £200,000, and occupied a large staff for 14 months. In his opinion the inventory substantially included only the proper plant.

(*To be continued.*)

AUSTRALIAN TRAMWAY COMPANIES AND THEIR EMPLOYÉS.—V.

THE cross-examination of Mr. Ovenden, a motorman in the employ of the Adelaide Tramway Company, was continued by Mr. Goodman, the manager of the company. Asked why they demanded double pay on holidays and Sundays, he stated that the greater number of passengers carried involved heavier work and extra responsibility. He also claimed that tramway employés should not be debarred from serving on Local Authorities or from going into hotels in uniform when off duty.

Mr. Simmons, a sweeper formerly with the Brisbane Co., gave evidence that he had only signed the petition for the cancellation of the men's union charter under fear of dismissal and on being told that he would not be liable for financial demands.

Mr. Kirby, a signalman on the Adelaide trams, stated that he was paid 1s. 1½d. per hour with overtime and Sunday pay at time and a quarter. Overtime commenced after eight hours. The claim, therefore, was for an advance from 9s. to 12s. per day. He claimed there was a great deal of responsibility in a signalman's duties. Some of them had asked for an increase of pay, but had been refused.

Mr. Iles, a pitman, stated that they asked for 11s. per day, and he was not aware that according to the claim forbidding work in repair shops and car factories after 5.15 p.m. at ordinary rate, the amount really demanded was about 20s. per day.

Mr. Foster, a fireman, said he was getting a little over £3 per week, and they were now asking for 12s. per day of eight hours. He did not know of any firemen being paid at that rate, but he considered the work very unhealthy.

The conditions at Hobart were then further inquired into. It will be remembered that Mr. Bryant, the secretary of this branch of the men's Union, had stated that after a general rise in wages given by the company, the men were not discontented with their wages. Mr. Buckley, a motorman, stated that his permanent wages were now £2 16s. per week, the hours 54 per week, and with overtime he averaged about £3 8s. per week. He could not understand why Mr. Bryant had made such a statement. Personally, and to his knowledge, some were very dissatisfied with the wages, hours and conditions of service, and wanted everything which had been asked for in the Union claim. It would appear that Mr. Marshall, a Melbourne conductor, visited Hobart, and persuaded the men there to form a branch of the Union. At the same period, efforts were made to form an Independent Workers' Union; this was done, however, without the knowledge or approval of the manager of the company, Mr. Parker.

At this stage the Judge intimated that he would be pleased to consider any suggestions the various managers might make to him as to what concessions might, in their opinion, be practicable. He quite understood that some of these might only be applicable to certain lines.

Mr. Lalorv, another Hobart motorman, testified to dissatisfaction with prevailing conditions, and intimated that he thought preference was given to members of the Independent Workers' Union over members of the claimant union.

Mr. Marshall, who had organised the Hobart branch, then gave evidence, stated that as a result of two meetings which he held over half the employés of the company joined his Union. The men were dissatisfied with their wages, lack of protection on the cars, and the absence of seats for motormen. Another ground of complaint was that motormen had to provide their own trousers, as in oiling the cars they got them soiled.

Mr. Wotton, a gripman on the Brunswick cable line, gave evidence in support of their claim to 11s. per day. He had been in the employ of the company for over 20 years, and had had very

few accidents. He had no holidays or extra pay for Sunday work. He did not know of any other body of employés except those on other tramway systems and the railways, who obtained annual leave of absence at the expense of the employers.

Mr. Snelling, an assistant track ganger with the Melbourne Co., stated that his present wages were 8s. 6d. per day, and at a meeting of trackmen the present claim for 12s. per day was decided upon. Asked whether if it had been suggested to ask for 13s. per day, he would have voted for it, he said yes, but did not know whether he was in favour of asking for 14s. per day. Mr. Prendergast, on behalf of the men's Union, then put in as evidence a number of replies he had received from various municipal councils showing the rates of pay of pitcher setters, labourers, members of tar gangs, &c. These ranged from 8s. 6d. to 11s. per day. The hearing was at this point adjourned.

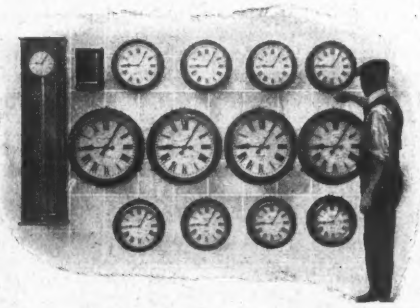
BUSINESS NOTES.

Extensions at Siemens Bros. Dynamo Works.—Messrs. Espley & Son, contractors, Stafford, have secured the contract (amounting to £9,000) for the enlargement of Messrs. Siemens's electrical works. The contemplated new building is to be erected between the existing works and the railway line, and when completed—it is stipulated it must be finished in a little over three months—it will enable the firm to employ 600 hands in addition to the 2,000 now in their employ at Stafford.

Italy.—La Societa Fabbrica Lampade Incandescenza, Longoni & Co., is the name of a new company which has lately been formed at Novi Ligure, Italy, to continue the manufacture of "Fulgor" electric lamps.

A.E.G. in Bulgaria.—The Allgemeine Electricitäts Gesellschaft has formed in Berlin a new company with a capital of £25,000, and the title the A.E.G. Bulgarische Electricitäts Gesellschaft, to look after the A.E.G. interests in Bulgaria.

Electric Clocks.—We illustrate a set of electric impulse clocks, which is one of a number of installations which Messrs. Gent & Co., of Leicester, have on hand at the moment. This particular set, which is under test before despatch, will be installed forthwith by Messrs. T. Burton & Co., of Blackburn (who are the contractors for the installation) in the Blackburn Police and Sessions Courts, now nearing completion. A feature of this installation is that the transmitter or master clock, is fitted with mechanism



Electric Clocks for Blackburn Sessions Court.

for receiving the daily Greenwich time signal, the mechanism being such that the clocks in the Courts will automatically show Greenwich mean time. In addition, the pendulum of the transmitter is provided with a rod of the new non-expanding nickel-steel alloy recently placed on the market by Messrs. Gent & Co., and known as "Sinevar." A feature of Gent's system is the weak battery warning bell, shown in the small case at the right hand of the master clock. This apparatus automatically gives timely warning when the battery needs attention. These clocks work with a very small current, and we understand that an installation is still working on the original battery of ordinary Leclanché cells which were installed with the clocks three years ago.

Effect of Foreign Prices.—At last week's meeting of Accrington Town Council, Alderman Higham said that tenders from foreign firms for electrical necessities were considerably lower than those received from English firms. The Electricity Committee had, however, prevailed upon English firms to modify their prices, and so the tender of one of them had been accepted. The purchases were needed to carry out the Clayton-le-Moors electric power and lighting extension.

The Price of Aluminium.—We learn from the British Aluminium Co., Ltd., that the price of aluminium ingots is £75 per ton, not £70, as quoted in our "Market Quotations" last week.

For Sale.—Messrs. Mann, Egerton & Co., Ltd., Ipswich, have for disposal a quantity of electrical plant, accessories, carbon-filament lamps, &c. See our advertisement pages in this issue.

Buenos Ayres.—The Budget expenditure of the Argentine Republic for 1912 comprises, among other items, 2,650,000 fr. for new telegraphic lines, 13,000,000 fr. for hydraulic works, 18,000,000 fr. for the enlargement of the Port of Buenos Ayres, and 145,000,000 fr. for sundry works, including railway construction, bridges, &c.

Admiralty List.—The Lords Commissioners to the Admiralty have placed the name of the Midland Electric Manufacturing Co., Ltd., on the Admiralty list of contractors for the supply of small switchboards suitable for torpedo boat destroyers, frames and auto-charging, and also for switches up to 100 amperes rating.

Liquidations.—Globe Electric Co., Ltd.—At a meeting, held at 11, Farringdon Avenue, E.C., on June 3rd, a resolution was passed winding up the company. Mr. E. C. Pegler, 60, Watling Street, E.C., is liquidator. We are informed that this action has been taken on legal advice in regard to an agreement for the supply of a large quantity of arc lamps to a foreign customer, which agreement was not fulfilled owing to a third party. An action for damages has been commenced against the Globe Co., but it is stated that, should the liquidator of that company prosecute a claim against the supplier and succeed, the financial position of the company and its creditors would be improved. A meeting of creditors is to be held on June 18th at Cannon Street Hotel, E.C., at 12 o'clock.

City of Birmingham Tramways Co., Ltd.—This company is winding up voluntarily, with Messrs. H. W. Brettell and T. Bower as liquidators. The assets are to be sold to the Electrical and Industrial Finance Corporation, Ltd., upon terms set out in a letter of May 2nd from the B.E.T. Co., Ltd. A meeting of creditors will be held on June 17th at Electrical Federation Offices, Kingsway, W.C. Creditors must send in the usual particulars by July 8th to Mr. Bower.

British Tungsten Lamp Co., Ltd., Huyton Quarry, near Liverpool.—Liquidator's release dates from May 31st.

Cowper-Coles Galvanising Syndicate, Ltd.—This company is winding up voluntarily, in view of the sale of the assets to the Magnet Galvanising and Plating Co., Ltd. Mr. A. E. Tugwood, 9, Pattison Road, Child's Hill, N.W., is liquidator. A meeting of creditors is called for June 20th at 11, Ironmonger Lane, E.C.

Catalogues.—The British Thomson-Houston Co., Ltd., Rugby.—An eight-page list just issued (No. 2,290) gives in tabular form particulars of the Curtis steam turbines sold up to April 30th, 1912, including the name of customer, output, speed, pressure type, &c. They are classified in different sections, but a summary of all of these gives the following total result:—Great Britain and Ireland, Municipalities, 64,730 kw.; Tramways and Power Companies, 49,480 kw.; Railway Companies, 6,350 kw.; Collieries, 28,820 kw.; H.M. Government, 782 kw.; Industrial Applications, 24,411 kw.; Export, all purposes, 54,036 kw.; total, 228,609 kw.

Messrs. L. Andrew & Co., 2, Whitworth Street West, Deansgate, Manchester.—Leaflet giving particulars and prices of india-rubber gloves and gauntlets for electrical purposes, acid work, &c.

The Electrical Power Storage Co., Ltd., 4, Great Winchester Street, London, E.C.—New leaflet giving coloured illustrations, tabulated prices, and curves, of improved pattern E.C.C. dry-cells.

The British Thomson-Houston Co., Ltd., Mazda House, 77, Upper Thames Street, London, E.C.—Price list of "Mazda" automobile lamps, including lamps for headlight and rear-lights; and tubular and festoon lamps for interior lighting. These lamps range in size from 1 to 32 c.p. and in voltage, from 2 to 12 volts. Copies of this list (No. 344) will be sent on application.

Messrs. Siemens Bros. & Co., Ltd., Woolwich.—Catalogue No. 501, of 32 pages, containing illustrations and price particulars of cable-laying and erecting accessories, including india-rubber gloves and mats, blow-lamps, jointers' tents, tool-carts and kits, lifting jacks, cable suspenders, and sundry appliances. Several pages are devoted to prices of jointing materials, and there are also tables of wire gauges and copper conductors.

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, London, W.C.—New catalogue of 150 pages containing illustrations of a very large assortment of artistic electric light fittings. The contents include brackets, bronze figures, candle fittings, electroliers of many designs and several finishes, electroliers with Holophane glassware, lantern fittings for inside and outside service, and for street lighting, pendant fittings for various kinds of rooms, standards, water-tight fittings, reflectors, shades, switches and accessories. The catalogue is being issued to the trade generally.

The Warner International and Overseas Engineering Co., Ltd., Carteret Street, Westminster, S.W.—Eight-page pamphlet containing a reprint of an article in an engineering contemporary describing the non-parallel axle rolling stock.

Messrs. Newtons, Ltd., Taunton.—New catalogue of close upon 40 double pages in which a great deal of information is given relating to Zone dynamos and motors. Specification particulars of these machines and descriptive notes respecting their construction, diagrams of connections, tabulated dimensions, outputs and prices, are given. The contents also include information respecting boosters, motor-starting panels, paraffin and petrol-electric sets, motor-driven pumps, &c. The opening pages are occupied with useful electrical tables, data and general information, and a telegraph code. Copies of the book can be obtained on application.

Messrs. Simplex Conduits, Ltd., 116, Charing Cross Road, London, W.C.—Catalogue of 48 pages relating to the firm's electric

cooking and heating apparatus. It is divided into two sections, viz., "C" and "H," dealing with electric cooking utensils and electric radiators and convectors respectively. A brief general description of the Simplex system applicable to both sections is followed by Section "C," wherein there are excellent illustrations and brief tabulated notes and prices of appliances such as kettles, water heaters, urns, irons, hot cupboards, series boiling plates, and so forth. The firm are now specialising in supplying, or converting, high-class silver-plated goods to electric heating. These are intended for presentation purposes, &c. A range of five appliances is illustrated in the catalogue, consisting of two types of kettles, a foot-warmer, a chafing-dish and a toast-maker. In the heating section, in addition to ordinary types, are special patterns such as the Humidifier type, special convectors for office and corridor heating, car heating, special heaters for ship use, &c.

MESSRS. ALFRED WISEMAN, LTD., Glover Street, Birmingham.—74-page catalogue containing illustrations, prices, and code-words of a large variety of fittings for overhead tramway insulation, long-distance transmission material, gears, pinions, &c. Catenary suspension, high-tension straining towers and porcelain insulators are among the contents.

THE ELECTRICAL CO., LTD., 122-4, Charing Cross Road, London, W.C.—June leaflet giving a few notes and particulars of prices of D.C. and A.C. fans.

Diesel Engines.—MESSRS. MIRRLEES, BICKERTON AND DAY, LTD., Hazel Grove, Stockport, have recently received orders for the following Diesel engines, in addition to a large number of orders varying from 50 to 200 B.H.P.:—

One 500-B H.P. for the Moose Jaw Street Railway, Canada; one 750-B.H.P. for the Borough of Wallasey Electricity Works; one 320-B.H.P. for the Admiralty for Hong Kong Dock Yard; one 250-B.H.P. for St. Sampsons Electricity Works, Guernsey (repeat order); one 240-B H.P. for Messrs. Kodak, Ltd., Wealdstone; three 375-B.H.P., War Office, for Tidworth & Bulford Camp; two 240-B.H.P., Battleford Electricity Works, Canada; one 500-B.H.P., Khatau Makanji Spinning and Weaving Co., Bombay; two 240-B H.P., South-Eastern and Chatham Railway Co.'s works, Ashford; one 500-B.H.P., Messrs. Foy & Gibson's Woollen Mills, Fitzroy, Australia.

The firm have also several engines in hand for electric generating sets for new battleships for the British Admiralty and the Turkish Government, and seven engines for driving pumps for the Metropolitan Water Board.

Book Notices.—"Copenhagen and Its Environs" is a useful and interesting illustrated booklet which has been published free by the Danish Tourists' Association (Den Danske Turistforening). We understand that this is the first time such a guide to Copenhagen has been issued gratis, and readers who desire to have a copy should write to the bureau of the Association at Frederiksberggade, 14, Copenhagen.

"Shorthand for Electricians. The Oxford Shorthand (International Phonography), 23rd edition and After," is a 16-page illustrated descriptive booklet which the inventor, Mr. Percy Kingsford, Ellesmere Port, will send free to any reader of the ELECTRICAL REVIEW who writes promptly for it. It describes the system fully.

"The Economic Position of Ireland and its Relation to Tariff Reform. Published for the Tariff Commission, by P. S. King and Son, London. 3d.

The *Faraday House Journal* for June contains, amongst other interesting items, an article on the "Necaxa Power-House Dams and Pipe-Line," by Mr. E. B. Ritson, an old Faradian.

Bankruptcy Proceedings.—C. A. SMITH (trading as C. J. Smith, electrician, 23, King Street, Regent Street, London).—A supplemental dividend of 2d. in the £ is payable at Bankruptcy Buildings, Carey Street, W.C., on any day.

Cricket Match.—On Saturday last, on the Green at Sarisbury, a cricket match was played between the Portsmouth Dockyard electric generating station staff and the employés of Messrs. Johnson & Phillips, Ltd., of Old Charlton, which firm has been carrying out work in the Portsmouth Dockyard and at other naval shore establishments in the district for the past eight years. A long intimacy which had existed between those concerned added interest to the event. The match was somewhat evenly, but strongly, contested, and after several hours' play the contractors proved the victors. A very enjoyable repast was served at the New Inn, after which Mr. Harding, secretary to the electrical engineer of the Dockyard, made a presentation of a cricket-bat to Mr. J. Roberts, A.M.I.E.E., who has been the resident engineer for the contractors for several years. Mr. Roberts, in responding, thanked the donors, and hoped they would shortly be playing a return match.

Trade Announcements.—Owing to the rapid increase in the manufacturing branch of their business, MESSRS. ISENTHAL AND CO. have now removed the whole of their works and offices to the factory at Denzil Road, Neasden, to which address all correspondence should now be directed.

THE UNION CABLE CO., LTD., are this week moving into their new offices and factory at Dagenham Dock. The machinery for cable manufacture is not yet all erected, but it is expected that in about six weeks' time the company will be in a position to manufacture all sizes of rubber, paper and bitumen-insulated cables, lead-covered and armoured. The firm's new telephone number is "Rainham, 23," and their postal address Dagenham Dock, Essex.

MR. J. H. BAKER, late senior partner in the firm of Baker and Farnfield, has commenced business on his own account as a lighting engineer, at 59, Station Road, Town Hall Square, Bexhill-on-Sea.

MESSRS. H. B. BARNARD & SONS, of 144, Lambeth Walk, London, S.E., purchasers of old metals, have altered their telephone number to "Hop 1520."

MR. PHILIP S. DOHERTY has severed his connection with the Worthington Pump Co., Ltd., and has started as an engineer and agent on his own account at 25, Victoria Street, Westminster, S.W., representing, amongst others, the Eureka Pump Co., of Christiania.

The registered office of the OAKBANK OIL CO., LTD., has been altered to 29, St. Vincent Place, Glasgow.

GUALTIERO FARINA & Co. is the title of a new company with offices at Corso P. Nuova 9, Milan, and a capital of 10,000 lire, formed to act as agents for electrical goods.

MESSRS. FYFE, WILSON & Co. have removed to 155A, St. Vincent Street, Glasgow. Telephone Nos "City 7181 and 7182." The firm have the sole selling rights of the Kelvin petrol and paraffin-electric generating sets. They also represent the Electric Construction Co., Ltd., and the E.P.S. Co., Ltd.

LIGHTING and POWER NOTES.

Australia.—In the year ending December 31st, 1911, the Sydney electricity department sold 17,768,210 units, of which 1,742,207 were supplied to the street and park lamps and 16,026,003 units to private consumers. At the same date the total connections in lamps, motors, &c., were equivalent to 29,200 KW., of which 16,750 were in lamps and 12,450 in motors, &c. The number of separate premises connected amounted to 4,655. The gross revenue for the year was £172,693, of which working expenses absorbed £95,428, leaving a balance of £77,265. Interest, sinking fund contribution, depreciation, &c., took £48,874, leaving a surplus of profit on the year's working of £28,391. The sum of £95,428 for working expenses includes £17,596 paid to companies taken over by the City Council on account of goodwill.

Bacup.—The new cotton weaving shed which Messrs. Hoyle Bros., of Bacup, have decided to erect on a site near their Olive Mill, will be run by electricity on the individual drive system.

The T.C. has decided to retain the services of Mr. C. D. Taite as consulting electrical engineer.

Bexhill.—Notwithstanding the coal strike, which put up the costs towards the end of the financial year, and other adverse circumstances, there was a net profit of £360 on the Corporation's electric light undertaking during the past year. The total revenue from all sources was £11,439; working costs amounted to £6,192, and the gross profit was £5,247, which on the capital borrowed showed a return of 7 per cent. Interest and sinking fund absorbed £4,662, making the total costs for the year £11,078. Units sold for private lighting amounted to 434,978, with an average revenue per unit of 4·48d., while 198,621 units were sold for public lighting, for which the average revenue was 3·90d. The average revenue from both private and public lighting was 4·19d. per unit. The cost per unit was 2·33d., compared with 2·28d. the previous year. The number of consumers connected last year (105) was, with one exception, the largest since the first year of working. The engineer (Mr. W. T. Le Feuvre) reports that the general adoption of the metal-filament lamps has proved thoroughly satisfactory, and considers that the reduced cost of the lamp renewals indicates that a better and stronger lamp is now on the market.

Birkenhead.—On the minutes of the Electricity Committee coming before the T.C. at a recent meeting the department was criticised, one of the members comparing it with the neighbouring undertaking at Wallasey, and a proposal was moved and seconded that the minutes, which included references as to the borrowing of £20,000 and £14,230 respectively, for distributing mains and extensions to plant, be referred back. It was urged, on the other hand, that in 12 months' time the concern would be in a prosperous condition. The chairman (Mr. Clarke), in replying to the discussion, stated that while he could not commit his Committee to having a check taken of the stock and stores by the borough treasurer, he would bring the matter before the Committee. On this understanding the amendment was withdrawn, and the Committee's minutes approved.

The estimate of expenditure upon the extensions to the plant at the Craven Street and Bentinck Street power stations is:—For two 750-KW. mixed pressure turbines and generators, together with surface condensers, pumps, steam pipes, switchboard and gear, cables, &c., £12,400; foundations, £250; high-pressure steam pipe between Craven Street and Bentinck Street stations, together with superheaters for nine boilers, £1,580. Application is to be made to the L.G.B. for sanction to borrow the amount required for the scheme, £34,230, less £1,600 for meters, which will be provided out of revenue.

Birmingham.—The accounts of the Electricity Department for the year ended March last occupy more pages than usual, as they incorporate the figures for the added areas of Handsworth and Aston Manor. For the old area, a total of 40,190,547 units were sold, including 13½ millions for traction purposes, and the motor H.P. connections totalled 32,584. The gross revenue amounted to £236,990 and the gross profit to £129,231. This, after meeting loan charges, was allocated £25,000 to renewals—the fund now standing at £52,586, while £20,237 was contributed to the rates. The reserve fund account which benefited by interest, &c., on investments, now stands at £77,958. In the Handsworth area 1,955,398 units were sold, including 1,149,116 for tramways. The revenue amounted to £14,098 and the gross profit to £7,633, leaving a

surplus of £1,343 on the year. In the Aston Manor area, 7,519,161 units were sold, the maximum load being 4,180 KW. The total revenue amounted to £37,687 and the gross profit to £13,430. After meeting loan charges, £3,616 was placed to renewals, that fund now standing at £4,265. The capital expenditure on the three undertakings is: Birmingham, £1,535,693; Handsworth, £77,909; Aston Manor, £195,953—a total of £1,809,555.

Bootle.—It was reported at a meeting of the Electricity Committee that a number of cables were required between the new generating works and Marsh Lane, and it was recommended that a new conduit line with a few spare ways be laid at an estimated cost £590. Messrs. Callender had been asked to submit a tender, but the Committee recommended that unless the amount of the tender was lower than the cost of executing the same by the department, the work be carried out by its own staff. The T.C. at its meeting on June 5th, adopted the recommendation. The borough electrical engineer reported an inquiry from Messrs. Harland & Wolff, as to the terms of a supply of electricity for their new ship-repairing works at the North Dockyard.

Burton-on-Trent.—Sanction has been received from the L.G.B. to the borrowing of £14,555 for extensions to plant at the electricity works. This amount includes £1,993 for mains, £4,788 for a turbo-alternator and switch gear, and £2,280 for a rotary converter. As requested by the Board, it has been decided to return the sanction for £600 for new meters granted some time ago, as the Council has decided to pay for these out of revenue.

Chester.—The T.C. has been informed that the L.G.B. has sanctioned loans amounting to £14,000 in respect of the scheme devised by Mr. S. E. Britton, electrical engineer to the Council, for the erection of a hydro-electrical plant on the River Dee. Of the total amount, £7,090 is for plant consisting of turbines and dynamos, a grant of £500 to the Dee Fishery Board, for the construction of a fish pass, and £1,610 for crane, cables and power house. In addition, £1,500 is to be paid out of reserve.

China.—The annual statement of the Shanghai municipal electricity department contains much of interest to our readers, as showing the progress of electrical matters in this important Chinese city. Briefly some 8,300,000 units were sold and accounted for during the year ending 1911—an increase of 21 per cent. on the previous year. Besides private supply, the output includes 913,000 units for public lighting, 58,580 for heating and cooking, 761,000 for power, and 2,550,000 for traction. The load factor recorded was 23·65 per cent., and the maximum load, on Coronation Night, June 22nd, 4,200 KW. The net result of the year, after meeting interest charges £12,306, and depreciation charges £15,157, was a profit of £13,777, but sums were also applied out of revenue towards the cost of new plant, which might have been charged to capital. A great deal of information is contained in the report, from which we note that 73 miles of additional mains were installed, nearly all overhead; four new transformer sub-stations were erected, bringing the total to 68 transforming centres, with an aggregate transformer capacity of 5,145 KW.; 52,000 additional 30-watt lamps (including fans, heaters and cookers, but excluding street lamps) were connected, as against 25,000 in 1910, and 50 per cent. of these were for Chinese consumers. There were 791 additional fans, bringing the total to 4,848, and the heating and cooking connections increased during the year by 218 per cent. reaching 381 KW., being a most satisfactory feature. The motor load, which we gather offers great possibilities, increased by 705 H.P. to a total of 1,775 H.P., and includes the first electrically-driven flour mill in China, while negotiations are now in hand for the supply of 2,200 H.P. of motors, in addition to the normal connections which may be expected. For public lighting purposes there were 350 arc lamps and 632 metal lamps in use, the majority of the former being enclosed arcs, while the latter varied from 60 to 400 C.P. Particular attention is drawn to the success with which electric radiators and heaters have been introduced by the hiring branch of the department, without which it is considered that this form of heating would have remained undeveloped for years. The report states that electric lighting is being more and more used by the Chinese, and indicates great extensions in this direction; while as regards power supply, it is expected that the new 4,000-KW. Riverside power station, now being built, will not be able to do more than meet the demands of local mills and factories for about two years. The undertaking is under the control of Mr. T. H. U. Aldridge, who is to be congratulated on the forward state of electricity supply work in Shanghai.

Continental Notes.—FRANCE.—The industries of France make use of power to an aggregate of 3,550,000 H.P., of which 2,604,000 are supplied by steam, 773,000 by electricity, and 173,000 by various other means. The 773,000 electric H.P. represents the harnessing of 55,000 falls, 76 per cent. of which do not yield more than 10 H.P. Water-generated electricity has received its greatest extension in the Alpine region. Savoy makes use of 104,000 H.P.; the department of the Isere, 970,000 H.P.; Upper Savoy, 34,000 H.P.; the Alpes Maritimes, 17,000 H.P.; and the Rhone, 10,000 H.P., &c. In the Pyrenees region there are 70,000 H.P. utilised; 16,000 H.P. in the Tarn district; 14,000 H.P. in that of Puy-de-Dome; 10,000 H.P. in Haute Vienne; 19,000 H.P. in the Vosges; 16,000 H.P. in the Ain department; 15,000 H.P. in that of the Daubs; 13,000 H.P. in the Jura, &c. These various figures are, moreover, subject to steady increase. To the 3,550,000 H.P. allocated to French industries must be added 1,200,000 H.P. for commercial navigation, and 400,000 H.P. for automobiles and motor-cycles.—*La Lumière Electrique.*

The City of Paris is about establishing a new gasworks which will comprise an electric station. All the machinery and apparatus will be worked by electricity, and will be controlled from a central cabin in each workshop.

GERMANY.—The Niedersachische Kraftwerke Gesellschaft is the name of a new company which has lately been formed at Osnabruck, with a capital of £200,000, to establish a large electricity-generating station for the supply of current for lighting and power purposes in Lower Saxony.

Crewe.—A Sub-Committee is to consider the question of reducing the rates for the supply of electricity for power purposes.

Dundee.—Dealing with the finance of the Corporation Electricity Department at the T.C., Treasurer Soutar said the past year had been a record one for the department, the accounts closing with a net surplus of £10,338. The units sold were 8,354,466, an increase of fully 600,000. The total income amounted to £49,359, an increase of £3,300, while the costs showed reduction of £300, notwithstanding the fact that the assessments and taxes were increased by fully £800. When the conversion of the system from L.T. to H.T. took place £22,000 was shown to be the resulting depreciation, and when borrowing powers were asked in 1908, the Secretary for Scotland stipulated that this should be paid off in five years. Although there was still another year to run the department had been able to pay off the full balance this year. The remainder of the profit, amounting to £5,039, had been added to reserve fund, which now amounted to £14,356. It was proposed to further reduce the rates for next year. For power supply the sliding scale would still be in operation, but instead of starting at 2½d. per unit it had been reduced to 1½d. for the first 10,000 units per quarter, the next 40,000 units ¾d., and all above 50,000 units ⅝d. The ⅝d. rate under the guarantee and two-rate system was in future to be ¾d., with the incentive to consumers that they could have all units above 50,000 at ⅝d. With regard to lighting, if a consumer would guarantee the average number of units and price he had paid during the last three years all units in excess of this amount would be charged at heating and cooking rates, viz., 1½d. for the first 100 units per quarter, and ⅝d. for all above that amount per quarter. Mr. Nairn, the electricity convener, said the changes would be appreciated, especially by the manufacturers, who might now have an electric drive at a price which compared favourably with any other city. He emphasised the need for building up a good reserve fund for the department, pointing out that there were so many improvements being effected in electrical equipment that they could never tell when it would be found advisable to scrap some of their plant. The meeting agreed to fix the rates at the figures mentioned.

Dover.—The result of the last year's operation of the electricity department was a net profit of £3,254, which was utilised in reducing the outstanding deficit on net revenue account, which now stands at £1,370.

East Ham.—The Electric Lighting Committee reports having had under consideration a report upon the cost of lighting the whole of the streets at present cabled by electricity. It has decided as an experiment to authorise the engineer and manager to convert and adapt for electricity the existing street lamp columns in certain streets.

Falkirk.—Recent increases in the business of the Corporation electricity department have rendered additions necessary, and plans for an extension of the works, costing £1,300, have been submitted by the T.C. and passed. Some time ago there was an extension of cables to Bainsford, and now Camelon is also supplied with electricity.

Felixstowe and Walton.—The U.D.C. has decided to borrow £2,031 for extensions to the electrical plant for the Suffolk Electricity Supply Co., Ltd.; the question of converting the arc lighting on the front to metal-filament lighting is being considered.

Feltham.—In reply to a letter received by the District Council in regard to a proposed electric lighting syndicate, the clerk has been instructed to state that the Council has at present no intention of applying for power to supply the district with electricity, but it would be willing to favourably consider an application promoted by private enterprise for such powers.

Hastings.—At the last meeting of the T.C., at which the annual accounts of the electricity department (particulars have already appeared in our columns) were presented, Councillor Hill (chairman of the Committee) said they were better off to the extent of £1,760 compared with last year. The only extra increase in expenditure had been £353 in respect to coal. They had increased the number of private consumers and the number of street lamps. The electrical exhibition, carried out by the enterprise of Mr. Ferguson, was a great success, and had brought them a number of new consumers.

Hornsey.—Application is to be made to the L.G.B. for sanction to borrow £4,000 for mains extensions. According to the report of the professional accountant the electricity undertaking shows a profit for the year of £2,038, after charging all instalments and interest on loans properly chargeable against the year's revenue. This profit, added to credit balance at the beginning of the year, gives a total of £5,140, which is reduced by £984, balance of interest on loans accrued due, but not chargeable against the year's profits, leaving a credit balance carried forward at March 31st, 1912, of £4,156.

Kingston-on-Thames.—A L.G.B. inquiry was held on June 11th into the application of the T.C. for a loan of £13,500 for electricity purposes.

Korea.—A charter has been granted to the Okura Co. to supply electrical energy for power purposes at the gold mines in Korea. The generating plant will be installed at the Penhsihu Collieries.

The British Acting Consul-General at Seoul reports that a Tokio company, acting as agents for a well-known German firm, have prepared a scheme for supplying electric power to the gold and other mining companies in North Pyeng-an Province, and will devote a capital of about £102,000 to the purpose. The German firm will supply all the necessary plant and machinery, which will be similar to that installed at the Fushun coal mines. The new power plant will be erected at Reibi, just north of Shinanju on the Seoul-Wiju Railway, and power and light will be supplied to Unsan and Kosung, as well as to neighbouring towns such as Shinanju, Yengben, and Pukchin. In view of the increasing scarcity of wood-fuel, this new enterprise is of great importance to the mining interests of north-west Korea.

Leigh.—The town clerk has been instructed to make application for the sanction of the L.G.B. to the borrowing of the sum of £2,511 to cover the probable cost of extensions to mains and new services for the three years ending March 31st, 1915.

Lewes.—The T.C. has sealed a contract with the Electric Supply Co. for public lighting for a portion of the borough. The Council has asked the company to give a demonstration of different lamps.

London.—ISLINGTON.—The B.C. has again considered the report of the Electric Lighting Committee recommending that tenders be obtained for additional plant to cost £13,000. The proposal led to a lengthy discussion, in which the opposition of advocates of bulk supply played a prominent part, but in the end the Committee's recommendation was carried.

Macclesfield.—Mr. W. Essen, director of the new Electricity Co. of Macclesfield, Ltd., has informed the T.C. that the company is now negotiating for a site for a generating station, and that £25,000 capital had been secured to carry out the works.

Nelson.—The T.C. is applying for powers to borrow £3,000 for purposes of electric lighting in the district; the L.G.B. is instituting an inquiry.

Newton (Lancs.).—The U.D.C. has been informed that the B. of T. has declined to grant the Council's application for an electric lighting order, on the ground that there appeared to be no real demand for electricity, and that the scheme was too speculative and not likely to be a paying one.

Perth.—The T.C. has decided not to withdraw opposition to the Loch Erich Water and Power Scheme, unless certain clauses are inserted in the Bill safeguarding interests of the city.

Reading.—We are glad to be able to record that the Reading Electric Supply Co. has introduced a new tariff for cooking and heating purposes at 200 volts. Thus, where a supply is taken for lighting purposes, the charge is ½d. per unit, and where no lighting supply is taken, the charge is, for any amount up to 20 units per quarter, 13s. 4d. per quarter, with ½d. per unit for all extra energy consumed. No charge is made for the use of meters.

Runcorn.—The Mersey Power Co., Ltd., which is a subsidiary concern of the Salt Union, Ltd., and was originally formed to deal with the power for working the triple-effet vacuum plant for making salt at the Weston Point Works, Cheshire, has been informed that its application for consent to the erection of overhead electric cables under the provisions of the Runcorn Electric Lighting Order, 1910, has been granted. The scheme provides for the erection of a H.T. electric line for the purpose of supplying energy at a pressure of 6,300 volts between Runcorn and Helsby. It will connect to a sub-station to be erected near the pumping station, Ship Street, Frodham, and terminate on the premises of the British Insulated and Helsby Cables, Ltd., at Helsby.

St. Anne's-on-Sea.—It has been decided to apply to the B. of T. for a provisional order for supplying electricity in the urban district of Lytham for all public and private purposes. Notice of this has been served upon the Lytham U.D.C.

Sheffield.—The Special Committee appointed in connection with the electric light undertaking has decided to appoint a sub-committee to investigate such complaints as may be brought before it, with reference to the management of the commercial side of the undertaking, and the Electrical Traders' Association is to be invited to submit to the sub-committee and to support with evidence, such complaints as it may desire to make.

Skelton and Brotton.—At a meeting of the U.D.C. on Friday last, a letter was read from Messrs. Graham Bros., electrical engineers, withdrawing their offer to light the district by electricity, "owing to the attitude adopted by several members of the Council interested in the local gas companies."

Sowerby Bridge.—At the last meeting of the U.D.C. a circular letter was submitted from Mr. A. Wood, canal boat owner, Sowerby Bridge, in which he suggested a scheme for the propulsion of canal boats by electricity, utilising batteries.

Stretford.—During the year ending March 31st last, the total number of units generated amounted to 2,298,856, or an increase of 49,790, as compared with the previous year. Of the former number, 1,424,537 units were used for traction, 253,062 for private lighting, while 60,192 were unaccounted for.

Tonbridge.—The U.D.C. has decided to extend the mains in order to supply electricity for power to the works of the Whitefriars Press.

Tunbridge Wells.—The T.C. has decided to decline the offer of the National Electric Construction Co., Ltd., to accept one-half of the original cost of installations in the town carried out on the deferred payment system.

Wallasey.—The T.C., as a safeguard to the public supply of electricity in case of a coal strike, has decided to supplement the coal-fired plant at the electricity station by machinery operated by oil fuel. The plant to be installed consists of a 500-KW. alternator and Diesel engine, and it is proposed to apply to the L.G.B. for sanction to a loan of £6,980 to cover the expenditure.

Walsall.—An arrangement has been made with the Walsall Theatres Co., Ltd., which under it will take a minimum supply of 40,000 units per annum.

Watford.—The U.D.C. has applied to the L.G.B. for a loan of £9,253 for three years' requirements for the electricity undertaking.

Wimbledon.—On and after October 1st next, the charge for lighting purposes in the Maldens and Coombe district is to be reduced from 6d. to 5d. per unit.

Wolverhampton.—The Electricity Committee of the Corporation is to incur an expenditure not exceeding £100 in the purchase and equipment of a model house with electrical fittings for exhibition at the forthcoming Wolverhampton Floral Fête.

Worksop.—The U.D.C. has decided to ask the L.G.B. for permission to increase the loan for electric lighting extension by £200.

Yarmouth.—The annual financial statement of the Corporation electricity department shows that the gross trading profit was £9,191. Of this amount £702 was written off the cost of new meters, transformers, and other works, including part of the cost of altering the system of street lighting, for which there are no sinking funds, £7,898 applied to interest, sinking funds, rebates, and discounts, and £590 added to the appropriation account, making it £858.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The Corporation tramways show an increase in revenue for the past year of £3,705, and total receipts amounting to £77,175. The total number of passengers carried was 18,096,938, or upwards of 944,000 more than in the previous year, while the number of miles run was 1,643,242, or 23,739 more.

Aldershot-Farnborough.—The B. of T. has granted the application of the Aldershot and Farnborough Light Railway Co. for an extension of time for a year for constructing the line. The Aldershot U.D.C. has been officially informed that the National Electric Construction Co., Ltd., is engaged in raising the necessary capital, and has subscriptions amounting to between £30,000 and £40,000.

Argentina.—It is expected that the electric tramways in Mendoza will be finished by July 1st. The concession was granted to M. Herlitzka, who is looking after the construction for the company which acquired it from him. To commence with there will be 15 km. of line within the city, and it will afterwards be extended to the departments. Current will be supplied by the Hydro-Electric Works at Lujan.—*Review of the River Plate.*

Ayr.—The T.C. has agreed to extend the tramway system at a cost of £18,000. The Tramways Committee recommended that the railless system of traction should be adopted, but the recommendation was not discussed.

Birmingham.—Out of a surplus of £96,000 on the tramway undertaking of the Corporation, £50,000 is being carried to reserve and £46,000 towards the relief of the rates.

Blackpool.—The introduction of the "toast-rack" car for the circular route has been a great success; two were purchased last year, and the department soon bought six more. It was found that each of the cars could earn £10 a day. Last week it was decided to order four more "toast-rack" cars to be delivered in time for the approaching season, bringing the total to a dozen. The cars cost about £850 each and accommodate 70 passengers.

The Blackpool, St. Annes and Lytham Tramway Co. is claiming to be assessed at one-fourth the rateable value only for general district rate purposes, in accordance with the decision of the Tottenham case. The claim has been lodged with the St. Annes Council.

Clayton-le-Moors.—The B. of T. has confirmed the order made by the Light Railway Commissioners, authorising the construction of a light railway.

Continental Notes.—ALSACE-LORRAINE.—Plans are being prepared in respect of a projected electric tramway in the town of Markirch.

AUSTRIA.—Permission to undertake the preliminary surveys has been accorded to Eduard August Schroeder, of Teschen, for an electric railway from Teschen, through Bobrek, Krasra, Baumgarten and Haalach, to Pogwisdau.—*Elek. und Masch.*

FRANCE.—The management of the Compagnie du Midi have voted a sum of 1,800,000 fr. for the completion of the electrification of the line from Perpignan to Villefranche de Conflent. The company have also decided to construct forthwith a new hydro-electric station near Pontpédrousse, utilising the waters of the Cassagne station coming from the Bouillouses.

A Presidential decree has declared as of public utility the conversion to electric traction of the line of steam tramways from Bayonne to Biarritz, and that to the Lycée de Marrac; also other modifications detailed in the plans. The works must be completed within the space of two years.

ITALY.—The Italian Railways Co. has at last decided to resume the operations for the conversion to electric traction of the line from Modane to Bussoleno, interrupted a year ago owing to non-fulfilment of certain administrative formalities. Public demands for the conversion of the line have been frequent for a long time past, and recently the French Government has taken action to such effect, that the Italian Government has decided to resume the conversion works at an early date. Electric driving will not only tend to speedier transit, but will suppress the smoke nuisance in the tunnel, and both advantages will facilitate the increase of the flow of tourist traffic.—*La Revue Pratique de l'Electricité.*

La Società Generale Italiana Edison di Electricita, of Milan, has recently secured concessions for the construction and working of electric tramways between Affori and Varedi, and between Corsico and Abbiategrasse.

SPAIN.—It is proposed to construct an electric light railway between San Adrian and Barcelona; the power station will be at the latter town.

RUSSIA.—The municipal authorities of Minsk are reported to be considering a scheme for the construction of an electric tramway in the town.

SWITZERLAND.—The Federal Council has submitted to the Swiss Chamber the application for a concession made by MM. Glardon and Leresche, syndics of Vallorbe and Ballaignes respectively, for an electric railway to be constructed be tween Day, Vallorbe and Ballaignes. The estimated cost of the undertaking is 700,000 fr.—*La Lumière Electrique.*

Coventry.—The electric tramway system recently purchased by the Corporation, is now under the management of a specially-appointed tramways committee, and its first recommendation to the City Council will be for sanction to a loan for the amount of the arbitrator's award, £202,132, and the following items:—Cost of arbitration, including the Tramway Co.'s taxed costs, £6,869; stamp duty upon the conveyance of the undertaking, £2,021; purchase of stock and provision of working capital, £5,000; and a sum of interest at 4 per cent. upon the amount of the arbitrator's award from January 1st last until the date when the purchase is actually completed. The Committee has decided to relay a short part of the single track with new rails and setts at the estimated cost of £605.

Darlington.—The T.C. has decided to obtain tenders for two cars of the double-deck type with covered-in top decks, capable of seating about 50 passengers. The cost will be between £1,200 and £1,300.

Dundee.—The Corporation Tramways have had another successful year. By the introduction of a penny-all-the-way fare syetem it was estimated that the revenue would diminish to the extent of £2,200, but the decrease of drawings on this account has turned out considerably less, the drop being restricted to between £400 and £500. The receipts are thus about £1,700 more than anticipated.

Glasgow.—The Tramways Committee is to receive a deputation of blind persons from Paisley in support of a petition by Paisley residents so afflicted for the permission to permit them to travel free on cars of the T.C. and of the Paisley Tramways Co. Consideration of a similar request by the blind people of Renfrew has been deferred.

Keighley.—The T.C. is applying to the B. of T. for an extension of time to September 20th, 1913, for commencing, and to September 20th, 1914, for completing, the works authorised by the Tramways Order, 1909.

Korea.—According to the local Press, a Tokio company has obtained the option to build an electric railway from a point on the Seoul-Wiju Railway near Shinanju to the Yalu River, traversing the mining districts of Unsan and Yengben, but details of the scheme are not yet forthcoming.—*Board of Trade Journal.*

Leeds.—In consequence of largely increasing tramway traffic, the tramway authorities propose to acquire some Corporation property in Sovereign Street, off Swinegate, for the extension of the Kirkstall Road depôt, at which at present there is insufficient workshop accommodation. The proposal is to erect off Swinegate sheds, capable of holding 30 to 40 cars, and one result of the adoption of the suggestion will be the saving of a lot of "dead" mileage when football and cricket matches, and other events, calls for an accelerated service of cars.

Leith.—For the year to May 15th last, the tramway revenue amounted to £34,056, an increase of £3,384 over the figures for the previous year. There were 9,339,324 passengers carried, an increase of 1,082,707. Penny tickets issued totalled 3,802,677, the value being £15,844, an increase of £1,004. The number of ½d. tickets issued was 817,634, amounting to £1,703, and the workmen's tickets totalled 1,540,190, amounting to £3,208 in value. This year there was a surplus of £2,076, as against a deficit last year of £1,903.

Little Hulton.—Last week the D.C. decided to urge upon the South Lancashire Tramways Co. the necessity for proceeding with the construction of tramways in the township, failing which other action in the matter is to be taken. The Tramways Co. renewed its powers for this work a couple of years or so ago.

London.—HAMMERSMITH.—The oft-recurring question of repairs to the London United Tramway track in the borough led to a long discussion and several resolutions being passed on June 5th. These in effect notify the company to at once repair its track; provide for a deputation to urge on the L.C.C. and the B. of T. the necessity of at once reconstructing the track; and urge the necessity of at once repairing the margins of the roads on which tracks are laid. The situation has become complicated owing to the L.C.C. having practically acquired the L.U. Tramways in the London area; some details are not as yet settled, and it is thought that these may possibly delay matters for an indefinite time.

The Select Committee of the House of Commons which has been considering the matter, has agreed to the running of not more than one trailer car attached to an ordinary car on the L.C.C. tramways, the first car only being electrically driven.

London-Southend Electrification.—The consideration of the Midland Co.'s Bill for purchasing the Tilbury line, in Parliament, led to Lord Claud Hamilton intimating that it was the intention of the Midland Co. to electrify the Tilbury and Southend line, and that the Great Eastern Co. would also be compelled to adopt the same course with its route.

Manchester.—The Tramways Committee on Tuesday approved of a recommendation that half-fares be charged for passengers under 16 years of age. The scholars' ticket system is to be abolished.

Mexico.—A new electric railway is to be constructed between the towns of Puebla and Atlixco. The concession for the construction and working of this has been granted to an American financier, Mr. James McCarthy.

Salford.—During a severe thunderstorm which broke over Salford shortly after one o'clock on Monday afternoon, the tramway wires in Regent Road, on the Corporation system, were struck by lightning, and the electric fittings of a car were fired causing considerable excitement. Fortunately, no one was injured, and the outbreak was speedily subdued.

The Corporation Tramways Committee is to be approached again with a view to securing the extension of its system from Peel Green to Irlam and Cadishead, two growing industrial localities.

Sheffield.—It is proposed to continue the doubling of the tramway line from Tapton Park Road, to a point near Manchester Road, at a total estimated cost of £10,475; also to renew and double the line in Nethergreen Road, at a cost of £2,300.

South Africa.—A railless traction system has been recommended for installation by the Germiston Municipality by Mr. H. N. Thomas, general manager of the Durban tramways. The total route suggested is 6½ miles in length, and the capital outlay would be £40,000.

An experimental mile of railless traction is to be constructed at Aberdeen, Cape Province. Only two cars will be purchased at first.—*British and South African Export Gazette.*

Southport.—The annual report of the Electricity and Tramways Committee shows a net profit of £2,151, an increase of £1,149. The Tramways Committee was merged with the Electricity Committee about two years ago, and although the two Committees show a profit this year, the tramways have themselves lost £4,000 in the last two years. The T.C. as a consequence has been recommended to engage the services of an expert to report upon the undertaking.

In connection with its scheme of electric railways in the district, the Lancashire and Yorkshire Railway Co. is erecting workshops, stores, &c., at the electrical department, Southport.

Stalybridge.—The strike on the Joint Board's Tramways still continued at the time of writing, negotiations with a view to a settlement having failed.

Westhoughton.—It is reported that further representations are to be made by influential ratepayers in this district to the Bolton Corporation with a view to securing the continuation of the Bolton tramways to Westhoughton.

Wolverhampton.—The total profit of the tramways for the last year amounted to £22,801, and after meeting financial charges, &c., amounting to £12,423, the balance was applied, £3,881 to renewals and £2,719 to reserve, also £3,777 in aid of the rates. The total receipts were £51,452, as compared with £48,909 in 1911; 11,253,196 passengers were carried, or 9·84d. per car-mile, and the percentage of working expenses to total revenue was 56·73.

Yarmouth.—The annual financial statement in connection with the electric tramways shows a gross profit of £8,584, as compared with £8,126 in the previous year. Bank interest amounted to £100. Loan charges for interest and sinking fund required the sum of £6,713, leaving £1,981 to be added to the appropriation account, and making a disposable balance of £2,434. The Council decided that £2,000 be transferred to the general renewal fund, which would then amount to £7,739.

TELEGRAPH and TELEPHONE NOTES.

Australia.—The wireless station at Hobart, Tasmania, has been opened by the Federal Postmaster-General. Working during the night time recently with one-twentieth of its power, the new Pennant Hills (Sydney) station reached every known official station within a radius of 2,000 miles, including Fremantle (2,000 miles), Suva (1,732 miles), Wellington (1,230 miles), and Macquarie Island (1,281 miles).

Austria.—The Austrian Government has established under the Ministry of Commerce a State department for wireless telegraphy, which will undertake the working of this service on board Austrian ships, the technical management to be in the hands of an inspectorate in Trieste. The system chosen for adoption is that of the Telefunken Co., and the six installations already carried out by the latter on six Austrian vessels will be purchased by the Government. The equipment for 26 other ships has been ordered, and will be made by the company's Austrian branch in Vienna.

Canada.—The first report of the Department of Railways and Canals, Ottawa, dealing with telephone operations in the Dominion, states that the total number of telephone organisations, which includes companies of all kinds, is 537. Of these, Ontario contributes 319, Quebec 32, New Brunswick 16, Nova Scotia 14, and Saskatchewan 143. In Alberta and Manitoba, practically all the separate companies which existed a few years ago have been merged under Government control, and in Saskatchewan the process of absorption is under way. The total liabilities amount to a little over $40,000,000. The total number of telephones in use is 302,759. The gross earnings of all the Canadian companies amounted to a little over $10,000,000; operating expenses were almost $7,000,000, leaving net earnings of slightly over $3,000,000. The equipment of all the companies' lines includes 687,728 miles of wire; of this, 576,712 is urban, and 111,015 rural. The total number of employés reported was 10,425, who received $915,636 per year.—*Electrical News.*

Marconi wireless equipment has been ordered for all the steamers of the Northern Navigation Co., the Grand Trunk Railway's Great Lakes route.

Germany.—A temporary wooden tower has been built pending the reconstruction of the Nauen wireless station. The permanent iron structure will not be finished for some months; it will be 250 m. high, and of much more solid character than its ill-fated forerunner. When it is completed experiments will be undertaken on the transmission of electric waves through the earth. The wires in this case will be sunk 100 m. in the earth.—*E.T.Z.*

Hull.—The annual report and accounts of the Corporation Telephone Department show gross receipts £13,279, and gross profit £5,555, compared with £12,550 and £5,026 in 1910-11. The total amount carried to loan repayment account is now £8,330; to temporary sinking fund, £3,716, and to reserve fund, £7,722 (including this year's surplus of £1,849). The system comprises 37 miles of pipe, and 4,133 miles of underground circuit (double), as well as 628 miles of overhead circuit. The proportion of telephones in use in Hull is one to 23 of the population, compared with one to 40 in Liverpool, and one to 48 in Manchester. The unlimited subscription is £6 6s. per annum, and the capital outlay per station is £19 13; measured service is given for £3 per annum, and 1d. per outward call. The royalty paid was £1,326. The original loan sanctioned in 1903 was £43,202, repayable in 25 annual payments, of which £7,265 has been repaid; a further loan was sanctioned in 1905, of which £19,526 was borrowed, to be repaid in 20 years by instalments, of which £3,716 has been repaid. The total indebtedness of the undertaking was therefore £62,728, of which £51,747 was outstanding on March 31st, 1912. During the eight years' working of the undertaking £10,981 has thus been repaid. According to the statement of Sir Alfred Cripps in connection with the telephone transfer, reported elsewhere in this issue, the Postmaster-General alleges that the Hull Corporation is now carrying on the undertaking as his agent.

Memorial to Wireless Operator.—A monument is to be erected in Godalming, to the memory of J. Phillips, the Marconi operator, who went down with the *Titanic*.

Peru.—The Government has just erected a wireless station on Mont San Cristobal, overlooking Lima, thus placing that city in communication with Iquitos.—*Revue Pratique de l'Electricité.*

U.S.A. Telegraph Operators' Dress.—According to the *Standard's* New York correspondent, the Western Union Telegraph Co. has a mutiny on its hands among its women employés because of an order just issued that no low-necked dresses, nor "peek-a-boo" blouses, nor sleeves shorter than elbow length, shall be worn during the hot summer months. Dr. Anna H. Shaw, president of the National Woman Suffrage Association, says that the style of dress affected by many girls who work in offices, justifies the Western Union's attitude, and that "it is the very girls who wear these things who get the most invitations to dinners and theatres, and the most marriage proposals. It is an outrage."

Wireless at Sea.—It is stated that new regulations, making wireless telegraphy compulsory for German vessels, will come into force on October 1st.

Venezuela.—The Government has decided to install wireless telegraph stations at La Guayra, Puerto Cabello, Maracaibo and Cumana. The Ministry of Trade will shortly publish full particulars regarding the conditions of tender for the constructional work.

West Africa.—A wireless station is to be put up at Accra, Gold Coast, by the Marconi Co.

A wireless station is also to be erected at Lusambo, in the heart of the Congo. It is hoped before long to be able to transmit messages direct between Belgium and the Congo.—*African Engineering.*

CONTRACTS OPEN and CLOSED.

OPEN.

Alford (Lincs.).—June 24th. Public lighting for the U.D.C. Mr. Thos. N. Loy, clerk.

Australia.—WESTERN AUSTRALIA.—July 31st. Postmaster-General's Dept. Telegraph and telephone material. See "Official Notices" May 10th.

VICTORIA.—P.M.G., Melbourne.—July 23rd. Nine sections of a lamp-signalling trunk-line switchboard. See "Official Notices" April 5th.

N.S.W. GOVERNMENT RAILWAYS AND TRAMWAYS.—July 1st.—200-KW. motor-generator set for the Ultimo Power House. Specifications from the Electrical Engineer's Office, 61, Hunter Street, Sydney.

NEW SOUTH WALES.—July 31st. Common battery and automatic switchboards, for Newton, Glebe and Balmain, for the Postmaster-General's department. See "Official Notices" May 17th.

SOUTH AUSTRALIA.—October 1st. Telephone switchboards at Unley, Adelaide, for the Postmaster-General's department. See "Official Notices" May 17th.

October 1st.—Telephone switchboards at Norwood, for the P.M.G.'s department. See "Official Notices" May 24th.

October 22nd.—Telephone switchboard at Port Adelaide, for the P.M.G.'s Department. See "Official Notices" June 7th.

Austria.—VIENNA.—June 20th. Supply of a 40-ton electric crane for the station at Prague. Particulars of Fachabteilung der Zuförderungsdienst, Schwartzenbergplatz, 3, Vienna I.

Bedford.—June 19th. About 9,630 tons of coal (nutty slack), for the Corporation electricity works. Mr. Chas. Stimson, town clerk.

Bradford.—June 29th. Tramcar equipments, trucks, timber and car fittings, for the Corporation. See "Official Notices" to-day.

Bridlington.—June 21st. Smudge coal (about 2,000 tons), for the Corporation Electricity Works. Arthur J. Beckett, electrical engineer.

Briton Ferry.—June 19th. Overhead main, between Villiers Street and Grandison Hotel, for the U.D.C. See "Official Notices" June 7th.

Bury.—June 21st. Electric light installation and bore-hole pump at the Aitken Sanatorium, Holcombe, for the Bury and District Joint Hospital Board. See "Official Notices" June 7th.

Clacton-on-Sea.—June 19th. Electrical service fittings, joint box compound and bitumen, for a year, for the U.D.C. Mr. G. T. Lewis, clerk, Town Hall.

Croydon.—June 24th. Conversion of two hand lifts into automatic push-button control electric lifts, at the Infirmary, for the B. of G. See "Official Notices" June 7th.

Darlington.—The T.C. has decided to obtain tenders for two double-decked tramcars.

Dewsbury.—July 4th. One 1,000-KW. turbine, two 500-KW. D.C. generators, and jet condensing plant for the T.C. See "Official Notices" to-day.

Dublin.—June 27th. Extra-high-pressure and low-pressure cables, for the Corporation. See "Official Notices" June 7th.

Edinburgh.—School Board invites tenders for electric light installation at Tollcross School. Crawford & Cumming, 41, George Street.

Exminster.—June 22nd. Electrical appliances for a year, for the Devon County Lunatic Asylum. Mr. H. E. Morgan, clerk.

Grimsby.—June 18th. Electric lighting and fittings for the new Council School, Victoria Street, for the Education Authority. Mr. H. C. Scaping, architect, Court Chambers, Grimsby.

Hull.—June 21st. The Corporation is inviting tenders for 1,000 tons of tramway rails of special section in Sandberg steel, together with fishplates and soleplates. Specifications and forms of tender, £1 (returnable), from the City Engineer, Town Hall, Hull.

June 24th.—Mains for the Corporation Electricity Department. See "Official Notices" to-day.

Leith.—The Corporation Electricity Department invites tenders for coal. Mr. T. B. Laing, town clerk.

London.—POPLAR.—June 19th. Renewal of sub-circuit wiring, fuseboards, &c., at the Workhouse, for the B. of G. See "Official Notices" May 24th.

HACKNEY.—June 27th. Boiler plant, induced-draught plant, economiser, feed pumps, coaling plant, pipework, travelling crane, turbo-alternator, motor-generator or motor-converter, switchgear, &c., for the B.C. See "Official Notices" May 17th.

ST. PANCRAS.—June 17th. Two sets of motor-generator balancers for the B.C. See "Official Notices" June 7th.

HAMMERSMITH.—June 26th. High and low-tension switchgear and cable, for the B.C. See "Official Notices" to-day.

ISLINGTON.—July 24th. One 3,000-KW. steam turbine alternator, with exciter, condensing plant, switchgear, piping, &c., for the B.C. See "Official Notices" to-day.

STEPNEY.—July 1st. The Electricity Supply Committee is inviting tenders for meters, demand indicators, time-switches and carbons. See "Official Notices" to-day.

Manchester.—June 28th. Traction feeder cables and two years' supply of transformers, D.C. and A.C. motor starting switches, time switches and clock-controlled circuit-breakers, D.C. and A.C. motors, and meters, for the Corporation. See "Official Notices" to-day.

Newcastle-upon-Tyne.—June 28th. Nine-ton electrically-driven crane for use in connection with an anti-coal breakage appliance at No. 5 Coal Shipping Staith, Whitehill Point, for the Tyne Improvement Commission. Deposit £1. Mr. J. M. Manson, general manager and secretary, Tyne Improvement Commission.

New Zealand.—August 1st. Public Works Department. The following plant is required in connection with the Lake Coleridge electric power scheme. Section 3A.—Valves and expansion joints. Section 10A.—Steel standards for transmission lines. Section 10B.—Ferro-concrete standards for distribution line. Tenders to the Minister of Public Works, Public Works Office, Wellington, N.Z., from whom specification, &c., can be obtained. Deposit £200.—*Board of Trade Journal.*

H.M. Trade Commissioner reports a possible opening for trackless trams and commercial motor vehicles in New Zealand. Further particulars on application to the Commercial Intelligence Branch of the Board of Trade, London.—*Board of Trade Journal.*

Oldham.—June 21st. Steam, exhaust, drain and condenser pipes, oil separator, &c., for the Corporation Electricity Committee. See "Official Notices" May 31st.

Plymouth.—June 20th. High grade steam coal (8,000 tons), for the Corporation electricity works. Mr. E. G. Okell, electrical engineer, Prince Rock. £1 deposit (returnable).

Portsmouth.—June 27th. Permanent way material and electrical equipment in connection with the Twyford Avenue tramways route, for the Corporation. See "Official Notices" to-day.

Rotherham.—July 8th. (*a*) Tramway stores and materials for a year for the T.C., and (*b*) Electricity meters; (*a*) Tramways manager; (*b*) Borough electrical engineer.

River Plate.—According to the *Review of the River Plate*, the municipality of Santiago del Estero will shortly call for tenders for the installation of an electric tramway in that city. "The population is estimated at about 15,000 inhabitants, but it is rapidly increasing, and there has been a satisfactory development of business, due to the forestal industry of the province, which is progressing rapidly."

Rhondda.—July 18th. Refuse destructor, generating plant, mains, transformers and switchgear, for the U.D.C. See "Official Notices" to-day.

Sheffield.—June 28th. Roof principals and structural steelwork, for Neepsend power station extension, for the Corporation. See "Official Notices" to-day.

South Africa.—June 26th. Boksburg. Rolling stock, converter plant and overhead material for the railless trolley system. See reference to this matter in E.R., May 17th.

Spain.—July 2nd. Electric lighting of the City of Oviedo and its municipal buildings, for the Municipal Council. Board of Trade Commercial Intelligence Department, London.

MADRID.—According to the *Gaceta de Subastos*, of Madrid, the Consejo de la Compania Madrilena de Urbanisacion will receive offers for the supply of eight electric vehicles for the Colmtenar Railway; also for the rails for the branch line to the Asylum at Paloma.

Sweden.—June 22nd. Swedish Royal Board of Waterworks. 11,250-H.P. three-phase generator, 10,000 volts, 150 R.P.M.; transformers for raising to 70,000 volts. For State power station at Alfkarleby. For further particulars see this column for May 31st.

June 20th.—Swedish State Railways Administration. (1) 147,200 arc lamp carbons; and (2) 35,000 electric incandescent lamps. Tenders, marked "Anbud a baglampskol" in the case of (1), and "Anbud a glödlampor" in the case of (2), to be sent to "Kungliga Järnvägsstyrelsens Förradsbyra," Stockholm. Specifications and forms of tender (in Swedish) may be obtained, and an English translation of the specifications relating to the arc lamp carbons may be seen, at the Commercial Intelligence Branch of the Board of Trade, London, E.C.

Swindon.—June 22nd. Steam coal, for the Corporation. See "Official Notices" June 7th.

Swinton.—June 26th. Electric light installation at the Refuse Destructor, for the U.D.C. See "Official Notices" to-day.

Sunderland.—June 27th. Cooling tower, travelling crane and switchgear, for the Corporation. See "Official Notices" to-day.

Warrington.—June 25th. E.H.T. cable, for the Corporation. See "Official Notices" to-day.

West Ham.—June 17th. Installation of electric light at the Education Offices, The Grove, Stratford, and Colegrave Road schools, Stratford, for the Education Committee. See "Official Notices" May 24th.

Worksop.—June 17th and July 3rd. (*a*) Low-tension cables; and (*b*) battery switchboard and cast-iron exhaust pipes, for the U.D.C. See "Official Notices" to-day.

Worthing.—June 24th. 350 tons of Welsh coal through and through, 60 per cent. large, or washed nuts; 700 tons of Linby Head hard steam or Shirebrook loco. hard steam coal; and 150 tons of Tredegar large steam coal, for the Corporation Electricity Works. W. Verrall, town clerk.

CLOSED.

Accrington.—The correct title of the firm which received the contract for 15 tons of bitumen (see ELECTRICAL REVIEW last week, page 929), is the Dussek Bitumen Co. not the Dussek Trinidad Bitumen Co.

Barnsley.—The contract for the installation of electric light in the new premises of the London City and Midland Bank, Market Hill, has been secured by Mr. Fred Burns, Barnsley.

Bedford.—The Borough Education Committee has accepted the tender of Mr. R. H. Crawley, of Bedford, for electrical work for six months.

Belfast.—The Corporation has accepted the tender of Messrs. Robert Dempster & Sons, Elland, for the supply and erection of electric telpher coke-handling plant, at £5,500.

Belgium.—Eight concerns submitted tenders last week to the Société Nationale des Chemins de Fer Vicinaux for the construction of the overhead conductors required in connection with the light electric railway between the Belgian capital and Halcht, the lowest offer being that of M. C. Duterme, of Brussels.

Bootle.—The T.C. has accepted the following tenders in connection with tramway renewals and improvements:—

The Railway and General Engineering Co., Ltd.—Facing 200 renewable plates to joints, at 29s. 3d. per joint.

Titan Trackwork Co., Ltd.—100 pairs of mild steel cranked fishplates, at 1s. 11d. per pair.

Thermit, Ltd.—Rail grinder and equipment complete.

The tender submitted by the British Insulated and Helsby Cables, Ltd., for the renewal of trolley wires, was accepted.

Bransby.—For installing the E.L. in 11 houses being erected here by Mr. S. Turner, the tender of Messrs. H. Burns and Sons, of Whitehaven, has been accepted.

Dartford.—The U.D.C. on June 6th accepted the following tenders:—

Browett, Lindley & Co., Ltd.—Steam generator, £3,081.
Foster Bros., Ltd.—Pipework and superheaters, £689.
Worthington Pump Co., Ltd.—Feed pump, £168.

East Ham.—The tender of Callender's Cable and Construction Co., Ltd., has been accepted by the T.C., at £1,705, for a supply of 75 sq. in. sectional area concentric, lead-covered and steel-armoured cable. They are also to supply a feeder pillar at £62 10s.

Felixstowe and Walton.—The U.D.C. has accepted the tender of Mr. Haydn Harrison for the conversion of the lamps on the Promenade from arcs to metal filament, at £146.

Germany.—The Deutsche Maschinenfabrik, of Duisberg, have secured a contract from the Harbour Authorities of Bremerhaven for the supply of two 50-ton electrically-driven cranes.

(*Continued on page* 971.)

GENERAL ELECTRIC DEVELOPMENTS.

NEW FAN WORKS AND CENTRAL STORES.

The steady growth of the General Electric Co. from its modest beginning a generation ago to the present time constitutes an object lesson in manufacturing progress and skilful business organisation of which the directors may well be proud. Since the company first started business in 1886 it has been our privilege from time to time to visit its various manufacturing establishments in London, Birmingham and Manchester, as these have been brought into use, and on Friday last through the courtesy of the company we were able to inspect the latest addition, consisting of several new bays, which are devoted primarily to fan making and small motor building.

Carbon works. New fan works. Large machine shops. Central stores. Conduit works.

The Witton Works of the General Electric Co., Ltd.

Coil Winding Bay, New Fan Works.

This department was originally started in Manchester and removed to Witton some two years ago, when for some time it shared the present switchgear accommodation. The growth of both departments soon required a re-arrangement, and as a result, the new shop has recently been erected to accommodate the small motor and fan work. It consists of six single storey bays, each 300 ft. by 30 ft. of girder construction with brick filled walls and saw-tooth roof with windows giving a north light. The artificial illumination is effected by Osram high candle-power lamps, suspended from the roof, with individual lights for some of the machines. Each bay is spanned by a chain operated power travelling crane and the floors are served by narrow gauge tramways. All the machine tools are electrically driven; some individually, and others in groups according to suitability. The stores are arranged across the end of the bays, so that successive bays may be added without disturbing existing arrangements. A despatch department will be arranged correspondingly across the other end of three bays, thus providing a natural flow of manufacture from stores to despatch. The first bay is devoted to press work and is well equipped with modern tools, large and small, mostly by Messrs. Taylor & Challen, for all classes of sheet metal stampings. Small armature rotor and stator punchings are produced complete in one operation from the blank, while under the indexing presses segmental stampings have been made up to 18 ft. diameter, the department being equipped for meeting the whole of the demand at Witton.

Conveniently adjacent in the next bay is the die, jig and tool making department, which is staffed with expert tool makers, many of whom have worked with the company a great number of years.

The greatest care is exercised to ensure the accuracy of dies and small tools, for it is just at this point that the interchangeability or otherwise of most component parts is settled for the whole works.

The machining department for manufacturing is in the third bay, the equipment of which is specially adapted for the rapid production of interchangeable work.

The tools include seven duplex boring mills together with turret lathes, grinding machines, millers, profilers, &c. The most recent addition is a large all-geared horizontal milling machine driven by its own motor on an extended baseplate.

Machine Bay, New Fan Works.

Both in this and the adjacent winding and assembly departments everthing is manufactured in the same systematic way as for large machines.

Every part of even the smallest motor is machined or

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drilled to jig, and mechanically gauged or electrically tested after each single operation, so that assembling does not necessitate hand fitting and interchangeability is assured.

All the work in the shop is done on the piecework system, and before each operation is paid for the inspector must sign approval of the work on the piecework ticket. A staff of about 400 hands has been specially trained in this class of work by the foremen and inspectors, and consequently only an almost negligible amount of work is turned back as scrap.

General View of the Assembly Bay, New Fan Works.

All motor parts are made on the company's premises, the castings being produced in a wing of the foundry devoted to machine moulding and small castings.

The armature and field coils are wound in one of the bays shown in our views, and insulated by hand, or machine wound according to size. As an example of the system of inspection adopted, the armature shaft, core and commutator are checked, tested and assembled; the coils, wound on formers, are tested for resistance, taped and placed in the armature slots (which are lined), then tested for earths, short or open circuit, or reversal of connections; soldered to commutator; tested again; dipped in varnish and stove dried twice; the commutators turned; the whole tested finally and then sent to stores as a finished component.

Assembly Bay; Test Bench on the Right.

Most of the girls are provided with a single testing equipment; but the tests which each makes before passing on her own work are duplicated in an official test room.

In the case of all standard work, both the finished article and component parts are manufactured to stock, and in assembling the finished article, the parts are drawn from the stores.

The motors are flash-tested at from 500 to 1,000 volts A.C., according to size, and further insulation, running and silence tests are carried out.

The new works at present deal with small alternating and direct-current motors of from $\frac{1}{30}$th to 2 H.P., which, in addition to fan driving, are largely used for working advertising signs, emery wheels, vacuum cleaners, &c.

The company, of course, manufactures fans of every description—desk, ceiling, oscillating and revolving fans for any purpose, punkahs for use in tropical climates, and exhaust fans up to 42 in. diameter.

The company's now well-known "Freezor" fan has been arrived at after long trial and experiment, and it is claimed, for instance, that the 12-in. "Freezor Liteweight" fan represents a saving over 40 per cent. in energy for the same effect, as compared with many similar 12-in. fans; moreover, the weight has, by careful design, been reduced to only 10 lb.

In addition to the newly built fan department, the visitors were enabled to inspect other portions of the works, including the works power station and test house, the foundry, the large machine shops, switchgear and arc-lamp departments, and, last, the recently completed central stores.

Of particular interest in the large machine shops were the examples of turbo-electric machinery under construction, including two 3,000-KW. machines for Poplar. In the case of turbo-alternator work, it is the firm's practice to machine rotor and shaft from the solid, the coils being placed in

open slots, closed by metal wedges, while the projecting end turns are built up practically solid by hard wood packing pieces, secured in position by enclosing end shields. The slots under the rotor windings and through the poles are utilised for ventilation purposes.

We understand that the company has recently secured both Belgian and Dutch contracts, in competition with Continental firms; as regards the latter, the 1,000-KW. "outside" fly-wheel alternator intended for a cotton mill in Holland, attracted considerable attention by reason of its novel design.

An interesting feature was several large Witton-Kramer lifting magnets for 9 or 10-ton lifts for a Japanese dockyard; the uses of these in conjunction with the company's electric runway hoists were demonstrated to the visitors. In the arc lamp department, which we were informed handled 50 per cent. more work last year than in the preceding 12 months, despite the competition of the high candle-power metal lamp, the Butt flame lamp in its latest form and the Angold magazine lamp were shown, the latter, it may be recalled, constructed for up to 100-hours burning, with 5 second periods of extinction when changing carbons.

The central stores is a recent development of great interest in connection with the selling end of the company's business. It consists of a three-storey building 350 ft. long, equipped with lifts, cranes, &c., for housing the finished stock from all the various works, which comprises, one might say, everything electrical, and its function is to supply at short notice the requirements of any of the company's numerous selling branches at home or abroad. That this may be successfully accomplished, a complete index is kept of every article in the building, and a complete stock list is issued weekly to all branches, so that stock delivery can be assured.

The scope of the company's activity at Witton may, to some extent, be gathered from our first view, and large as it now is, we understand that there will shortly be added the manufacture of electric heating and cooking apparatus, at present carried on at the Ileene Works — the company's fittings factory — at Edgbaston. Two at present unoccupied bays adjoining the fan works are to be equipped with a view to developing this growing branch of the electrical business.

In conclusion, we are indebted to the company for an instructive and enjoyable visit, towards which the courteous guidance of Dr. A. H. Railing, and the complete arrangements of Mr. H. C. Palmer, contributed not a little.

Some G.E.C. "Freezor" Fans Produced at Witton.

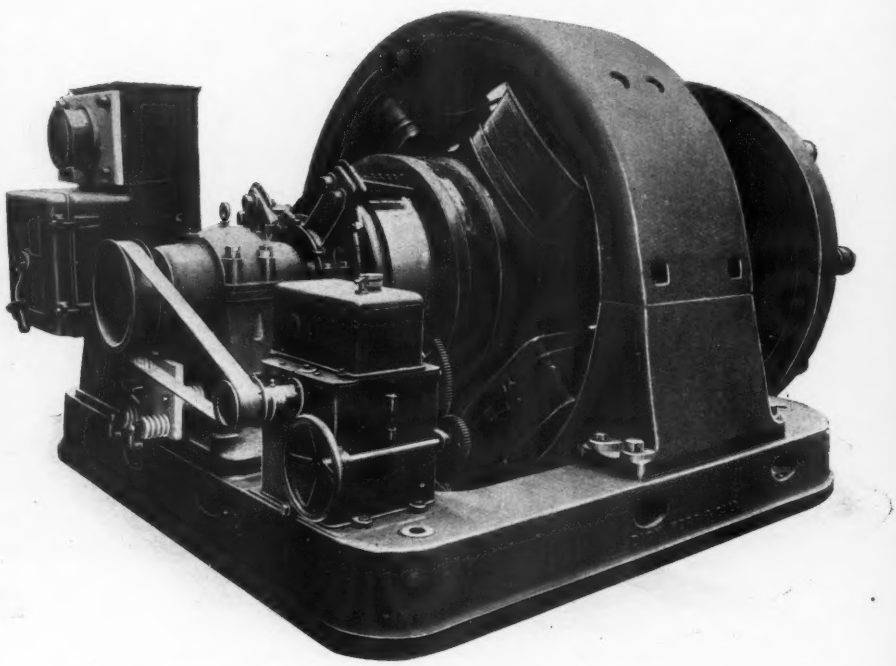
View in the Large Machine Shop, Witton Works.

THE HIGH-PRESSURE DIRECT-CURRENT SYSTEM OF THE METROPOLITAN CO.

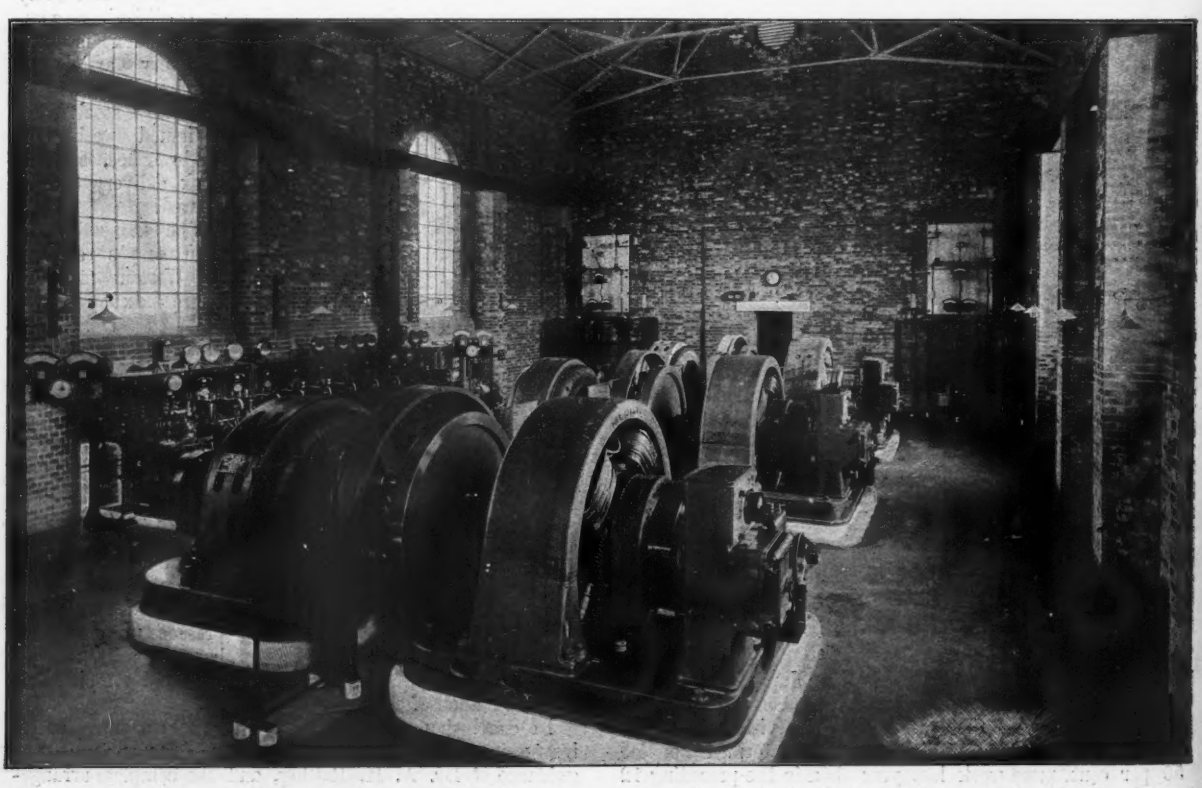
ON Monday last, by the courtesy of Mr. J. S. Highfield, engineer and manager of the Metropolitan Electric Supply Co., Ltd., we were enabled to inspect the installation of high-pressure direct-current plant which he has carried out, on the Thury system, for the supply of the western areas from the company's works at Willesden. This, being the first example of its kind in this country, is of exceptional interest; it is fully described in the paper read by Mr. Highfield at the Glasgow meeting of the I.E.E. on Wednesday, of which an abstract is commenced in this issue, and we reproduce herewith two views of the machines in the Ironbridge sub-station, one showing the complete installation and the other one of the motors.

As our readers will remember, Messrs. Dick, Kerr & Co., Ltd., some years ago took up licences under the Thury patents for this country, and they have carried out the work with entire success, the installation having operated from the start (March, 1911) with scarcely a single hitch.

We have on various occasions described the Thury system as installed on the Continent, where it is used to an extent hardly realised here; we may refer especially to the Moutiers-Lyons system (ELECTRICAL REVIEW, August 10th, 1906), supplying 4,300 KW. at 57,600 volts over a distance of 112 miles, and the St. Maurice-Lausanne installation (ELECTRICAL REVIEW, September 12th, 1902) supplying 4,000 KW. at 27,000 volts, but these are only two out of some scores of installations. There are certain advantages inherent to the use of direct current at high pressure on transmission lines which go far to counteract the drawbacks met with in the generating and converting plant employed



DICK, KERR 5,000-VOLT, 300-KW., D.C. MOTOR.



INTERIOR OF IRONBRIDGE SUB-STATION OF THE METROPOLITAN ELECTRIC SUPPLY CO., LTD.

in connection with it. The chief of these are the high efficiency at which the copper in the line is used; the greatly increased reliability of insulating materials when the electric stress is constant in direction; and the fact that the earth can be utilised as a return conductor in case of need. With the same maximum voltage stress on the insulation, and the same percentage loss in the line, a given weight of copper will transmit 50 per cent. more power on the direct-current system than on any alternating-current system. Experiment has proved the second claim, and the fact that the Board of Trade and the Post-master-General have sanctioned the use of an earth return at Willesden—after, of course, demonstration of non-interference with other interests—substantiates the third. Dielectric hysteresis, capacity current, low power factor, and inductive effects are all absent from the D.C. system, and the simplicity of the switchgear and of the running of the plant leaves nothing to be desired in this respect. A full discussion of the earth-return question is given in the concluding portion of Mr. Highfield's paper; the only disadvantage attaching to the earth as a return is the fact that it cannot be tapped, and therefore all the sub-stations must be looped in on the outgoing cable. But any section of the line between two sub-stations can be cut out by temporarily using the earth as a conductor, and thus the earth acts as an efficient stand-by. Mr. Highfield has found the Thury system the most economical means of providing a supply to the awkwardly situated areas in the west, and states that the cost of the line in many cases does not exceed that of an equivalent three-phase system employing over-head conductors. The cable is exceedingly simple—merely a single core heavily insulated with paper and lead-sheathed, ½-in. of paper sufficing for 100,000 volts; it was made by the British Insulated and Helsby Cables, Ltd. The generators work at up to 5,000 volts each, with a constant current of 100 amperes. Distribution is effected on the three-phase system, so that the whole of the high-pressure D.C. system is under the immediate control of the company's staff. The generators, motors and D.C. switchgear were made by Messrs. Dick, Kerr & Co., Ltd., and the three-phase switch-gear was supplied by Messrs. A. Reyrolle & Co., Ltd.

CONTRACTS CLOSED.

(Continued from page 966.)

Hastings.—The T.C., on June 7th, decided to accept the tender of the Oliver Arc Lamp, Ltd., for 100,000 pairs of carbons for Oriflamme arc lamps, at £2 15s. per 1,000 pairs.

Glasgow.—The T.C.'s Committee on Tramways, Works and Stores has recommended acceptance of the following tenders:—

Trolley poles.—Estler Bros.
D.C.C. wire.—London Electric Wire Co.; British Insulated and Helsby Cables, Ltd.
Lead-covered cables.—British Insulated & Helsby Cables, Ltd.
Special track work.—Lorain Steel Co.; Edgar Allen & Co., Ltd.; Hadfield's Steel Foundry Co., Ltd.

The Clyde Trust Navigation has accepted the offer by Sir W. G. Armstrong, Whitworth & Co., Ltd., to supply, at £565, the cradle and seat for the 32-ton electric crane being made for Rothesay Dock.

London.—The Brush Electrical Engineering Co., Ltd., has received the order for the supply of the whole of the incandescent lamps, with carbon and metal filaments, required in connection with the illumination of this year's Shepherd's Bush Exhibition. This is the outcome of the satisfactory results derived from the use of the firm's lamps at the Exhibition last year.

HACKNEY.—The B.C. has accepted the tenders of the British Insulated and Helsby Cables, Ltd. (the lowest submitted) for a supply of low-tension and extra-high-tension underground cables. The other tenderers were W. T. Glover, Callender's Cable Co., Siemens, Henleys, and Johnson & Phillips. For the supply of joint-boxes, frames and covers, it has been decided to divide the contract between (*a*) W. Lucy & Co., Ltd., and (*b*) the British Insulated and Helsby Cables, Ltd., as follows:—(*a*) Buried network boxes, dead end boxes, service tee boxes, terminal end boxes and frames and covers; (*b*) feeder network boxes, disconnecting network boxes, house service boxes and fittings, fuse boxes, meter boards, and special boxes and roadway frames and covers.

Montevideo.—The Uruguayan Government has accepted the tender of the Deutsche Maschinen Fabrik, of Germany, for the supply of 13 electric cranes for the port of Montevideo. The cost is $103,230 gold.—*Review of the River Plate.*

Morley. — The T.C. has accepted the tender of Belliss & Morcom, Ltd., for a new engine with base plate for the electricity works.

Newcastle-under-Lyme.—The T.C. on June 5th accepted the following tenders:—

J. Bagguley & Son.—Balancer, £90; alterations to switchboard, £306.
S. Wilton.—Alterations to engine room, £251.
Midland Coal, Coke & Iron Co.—Coal for a year, 15s. 6d. per ton.
Silverdale Coal Co., Ltd.—Slack for a year, 9s. 6d. per ton.

Sheffield.—The T.C. has accepted the tender of Brown Bayley's Steel Works, Ltd., for 500 steel tramcar tires, at 24s. 6d. each; also the tender of the British Electric Transformer Co., Ltd., at £1,010, for four transformers. An order is to be placed with Mr. T. Scott Anderson for welding 250 worn rail joints.

Walsall.—The tender of Cole, Marchent & Morley, Ltd., has been accepted by the T.C. for fitting up two tramcars with Spencer-Dawson automatic brakes, at £100 each, less 10 per cent.

Watford.—The U.D.C. has accepted the tender of Messrs. J. Howden & Co. for a new engine, at £455.

West Ham.—The T.C. has accepted the tender of Leslie and Co., Ltd., at £19,150, for carrying out extensions to the generating station; also the tender of Power's & Deane Ransomes, Ltd., at £2,144, for steel coal bunkers.

FORTHCOMING EVENTS.

Institution of Electrical Engineers.—Summer meeting at Glasgow.
Friday, June 14th.—At 9.35 a.m. Excursion on the Firth of Clyde. At 8 p.m.—At the Grosvenor Restaurant. Dinner.

Physical Society.—Friday, June 14th. At 8 p.m. At the Imperial College of Science, South Kensington. Papers on "Demonstration of a Method of Determining very Small Differences of Density," by Mr. T. H. Blakesley; "The Maximum Sensibility of a Duddell Vibration Galvanometer," by Dr. H. F. Haworth; and "An Accurate Examination of the Steinmetz Index for Transformer Iron, Stalloy and Cast Iron," by Mr. F. Stroude.

Municipal Electrical Association.—Annual Convention at Harrogate, June 18th to 21st inclusive. The proceedings include papers and discussions; visits to works at Leeds and Middlesbrough; a reception at the Kursaal and annual dinner at the Hotel Majestic (7.30 p.m. Wednesday). For further particulars see our note, page 867.

NOTES.

The Visit of the I.E.E. to Glasgow.—The summer meeting of the Institution of Electrical Engineers was opened on Wednesday morning at the Glasgow Royal Technical College, Mr. S. Z. de Ferranti presiding.

On behalf of the City of Glasgow, Lord Provost Stevenson gave a cordial welcome to the visitors, and, in doing so, he spoke of Glasgow's contributions to engineering generally. He referred to the forthcoming Smoke Abatement Exhibition, and asked the help of electricians to make Glasgow a smokeless city; if they could accomplish that, they would erect a monument which would never fade. Mr. Ferranti, in responding on behalf of the I.E.E., said that people did not realise the immense difference that it would make if there were really a general application of electricity for heating and power purposes. They admired Glasgow for pushing forward its scheme, having that object in view.

Mr. J. S. Highfield read his paper, which appears elsewhere in this issue, on "Transmission of Electrical Energy by Direct Current on the Series System," and in the discussion that followed Professors Marchant and Baily, Mr. Roger T. Smith, Dr. E. Rosenberg (of Manchester), Mr. Wigham (of Edmundson's Electricity Corporation), Mr. McWhirter, of Glasgow, and others took part.

Demonstrations followed in the Junior Laboratory and the dynamo room of the College. In the afternoon the party devoted itself to visiting works, dividing its attentions among the following: W. Beardmore & Co., Ltd., Dalmuir; John Brown & Co., Ltd., Clydebank; Clyde Valley power station, Yoker; and Yarrow & Co., Ltd., Scotstoun. Excursions through the city and to Rouken Glen were arranged for the ladies. On Wednesday evening the Lord Provost and Corporation gave a reception in the Municipal Buildings.

Yesterday (Thursday) the meeting was held at the James Watt Laboratory, Glasgow University.

After Prof. S. P. Thompson's lecture on "The Magnetism of Permanent Magnets," an experimental single-phase motor was described by Mr. J. S. Nicholson, B.Sc., and Mr. B. P. Haigh, B.Sc., and was afterwards shown running on load. This motor is fitted with pole-changing windings, and is worked as a repulsion motor. Up to half speed (500 R.P.M.) eight-pole connections are employed, while for higher speeds the windings are changed over to four poles, and the field is obtained by passing a magnetising current through the armature. It was pointed out that as a repulsion motor works best when running at a speed close to synchronous value, the use of a pole-changing winding allows of the best results being obtained over a wider range of speed than usual, as two synchronous speeds are available. The motor is started with the greater number of poles; and as the flux per pole is thus reduced to one half the usual value, the voltage induced in the armature turns is considerably reduced, and a much greater starting torque is obtainable without sparking. This effect was demon-

strated by starting the motor against a certain load with each of the two connections. With eight poles the motor started against full torque almost sparklessly, while, on the other hand, with four poles the sparking was excessive. By taking advantage of this improvement, it should be possible to build motors of greater output within given overall dimensions, as the commutator and windings require less space than in the standard type of repulsion motor. The action of the pole-changing motor when running at full speed is similar to that of other "compensated-repulsion" motors; thus the power-factor approximates to unity, and the motor may be used with shunt connections, in which case regenerative braking may be employed.

It was suggested that the motor was not only suitable for multiple-unit trains on account of its high acceleration, but also for locomotives required to handle high-speed passenger traffic by day and heavy goods trains by night. The method of changing the number of poles involves the use of switches, but as each transformer tapping gives two speed ranges instead of one, the total number of contactors is not greater than usual.

We understand that a paper dealing with the motor fully is in preparation for the coming Session of the Institution, and that this will give the results of exhaustive tests on the motor exhibited, which is rated at 10 H.P. at 850 R.P.M., 150 volts, 30 cycles. The motor was built by Messrs. Mavor & Coulson under Mr. B. P. Haigh's patents.

Ironmongers and Municipal Trading.—The Ironmongers' Federated Association, at their conference held at Glasgow at the end of May, spent part of their time very profitably in a discussion on municipal trading, the competition of the municipality in such matters as gas cookers, electrical fittings and apparatus, vacuum cleaners, &c., coming in for severe and searching criticism. One speaker referred to the effect of strong co-operative action on the part of the ironmongers of Stockport in stopping the hiring-out of vacuum cleaners there. Another member mentioned that Corporations had power to cut off the supply of light if customers failed to pay their bills for fittings and stoves, whereas the private trader had no such remedy. Yet another speaker urged all local associations to keep pegging away at municipal trading generally, and referred to the fact that the Electrical Contractors' Association was vigorously working to the same end. According to the report of the proceedings in the *Ironmonger* for June 1st the following resolution was carried unanimously:—"That this Federation, in conference assembled, places on record the increasing encroachment of the municipality upon the rights of the private trader, and calls upon all Ironmongers' Associations and kindred bodies throughout the country to use every effort to oppose all legislation for increasing the trading powers of municipalities in this direction, and advises all such associations to recommend their respective municipal authorities to sell their gas, electricity, and other products to the ratepayers at such prices as will cover the cost of production (including dead charges) only."

American Deputation to England.—Following a meeting of the Executive Council of the Department on Regulation of Interstate and Municipal Utilities of the National Civic Federation, it was announced that R. H. Whitten, librarian-statistician of the New York Public Service Commission for the First District, had been secured for approximately four months' special investigation work into the matter of public-service corporations in England. Mr. Whitten sailed recently from Boston and will proceed direct to London on his arrival at Liverpool. In his investigation particular emphasis will be given to the questions of profit-sharing, the sliding scale and control of capitalisation. The contemplated investigation in England is a part of the general scheme of the investigation that is being made by this department of the Civic Federation into the question of what constitutes adequate regulation of public utilities. The present investigation is the logical result of a former one which inquired into the merits of public ownership and operation.—*Electrical Review and Western Electrician.*

Copper.—The diminution in stocks over the whole month of May, as shown by Messrs. Merton's circular, is, for Europe, 5,183 tons. The withdrawals are chiefly from English ports, though Havre also has dropped 776 tons, and there is less afloat from Chile than at the end of April. Supplies from North America to Europe are about three-quarters of the average: from Spain and Portugal to England and France, the quantity is above the average. Chile shipments are down, but Australian are well maintained. The total deliveries are not unduly low at 39,891 tons. Rotterdam stocks were reduced 1,000 tons during the month, Hamburg rather more. The world's total visible supply was steady from the end of March to the end of April, but has dropped 21,678 tons since January 1st. American stocks appear to have increased during April by 1,205 tons, so that it would look as if the price was bringing up the output.

The copper position, from the point of view of the producer, has even been assisted by a strike, as we learn (from the *Ironmonger* of June 1st) that the shutting down of the Baltimore electrolytic refinery, by stopping a production of 500 tons a day, will distinctly affect the position. The point of view of the electrical manufacturer must necessarily be in favour of cheap copper, and the present shortening of supply, and increase of home consumption (in the States) coinciding with the earnest efforts of manufacturers to improve trade, has only the negative consolation of coincidence of misfortune. The stimulus to trade in the United States is evidenced by the figures of the Copper Producers' Association, which, as given in the *Times* for June 8th, show an increase of 465 tons in output for May as compared with March last, against an increase in home consumption of 2,328 tons. The stocks, compared with those of a year ago, have dropped 51,955 tons. Production for five months is given as 613 million lb., or 126·5 million lb. per month. In 1911 (*Financial News*) we find that the average production was 119·3 million lb. per month, and in 1910 it was 121 million lb. The domestic consumption for the same five months of 1912 is 65·6 million lb. per month, while the average for 1910 was 62·4 million lb. per month. Calculating from the basis of consumption of pig-iron, a writer in the *Ironmonger* estimates the United States consumption of copper for the current year to reach 337,350 tons, or a monthly average of 63·8 million lb.

Electricity in Mines.—At an inquest at Newport on the victims of an explosion at the Navigation Colliery, Bedwas, on March 27th, the theory put forward by the manager, Mr. James Jordan, and supported by Mr. E. L. Hann, mining engineer, was that a spark from an electric signal bell had ignited a small blower of gas. It was stated that experiments made at the Rhymney Valley rescue station showed that gas could be ignited at four volts.—*Standard.*

Bequest to Science.—Under the will of the late Sir Julius Wernher, £100,000 is bequeathed to the Imperial College of Science and Technology, South Kensington, to be used at the discretion of the Governing Body. Two-twelfths of the residuary estate (but not in excess of £50,000) will go in the same direction.

Gas Mantle Variations.—A French author, quoted by the *Gas World*, points out that there is room for improvement in the manufacture of gas mantles; what is wanted is uniformity rather than durability. At present, he says, the differences in lighting power among mantles from the same batch may amount to 40 per cent.

How an Appointment was Made.—According to the report of a speech by Councillor A. W. Tapp, in the *Chatham, Rochester and Gillingham News* of June 1st, the speaker referred to a matter which was recently mentioned in our "Correspondence" columns, as follows:—"A short time past an assistant was wanted at the Gillingham electric lighting works. One of the conditions of the advertisement was that applicants must have had experience with about 1,000 consumers. Three candidates were selected by the Committee. They had to come a good distance. On the night of the Council meeting the best one of these three should have been selected. After the interview one of the members of the Council asked why the local applicant had not been present. Another member moved that the local man should be allowed to come in. He was present, and was called in. He admitted that he had had nothing to do with electrical concerns for 15 years, and at that time he was at Chatham, and the number of consumers he dealt with was 250; yet he was appointed. Was that honourable? Were they prepared to support persons who did things like that?"

International Radio-Telegraphic Conference.—On Monday last the King and Queen received the delegates of the Conference, who were presented to their Majesties by the Postmaster-General and Sir Henry Babington Smith.

Institution and Lecture Notes.—THE MUNICIPAL TRAMWAYS ASSOCIATION (INCORPORATED).—A meeting of the Managers' Section of this Association was held at Cardiff on June 6th and 7th. About 40 members attended, and they were welcomed at the Council Chamber in the City Hall, in Cathays Park, by the Lord Mayor (Alderman J. W. Courtis, J.P.). The president (Mr. H. E. Blain) presided. Mr. Arthur Ellis, city electrical engineer and tramways manager, gave a lengthy and interesting description of the Cardiff City tramways system. Mr. L. Mackinnon, traffic superintendent of the Glasgow Corporation tramways, introduced a discussion on the Glasgow fare system. Due to the amount of discussion on these subjects, the paper on "Protective Devices for Motormen," was held over until the following day. At the invitation of the Lord Mayor, the members were entertained to luncheon in the City Hall, where they were joined by several members of the Electric Lighting and Tramways Committee. In the afternoon the members journeyed by special cars to the car depôt and power station, and were there afforded every facility for inspecting these places. In the absence of the Lord Mayor, Mr. Councillor Vivian, the deputy chairman of the Committee, took charge of the party, and with his able assistance, and that of Mr. Ellis, the members had a very interesting visit. Refreshments were provided, after which the members returned to town. To fill up the remainder of the day, a boat excursion was organised to Bristol, and the majority of the members took advantage of it, and had a most pleasant journey, which occupied about four hours, the weather being very favourable for the occasion.

On the Friday the members again assembled at the City Hall, and the following subjects were introduced for discussion: "Protective Devices for Motormen," Mr. A. Baker, general manager, Corporation Tramways, Birmingham; "The Relative Merits of Petrol 'Buses and Railless Trolley Vehicles," Mr. E. Hatton, general manager, Corporation Tramways, Newcastle; "Tramway Track: Methods of Construction and Maintenance," by Mr. J. Grierson, permanent way engineer, Glasgow; Mr. H. Mattinson, permanent way engineer, Manchester; and Mr. R. B. Holt, permanent way engineer, Leeds.

Hearty votes of thanks were accorded the Lord Mayor and Corporation of Cardiff, the Deputy Chairman and Members of the

Tramways Committee, to the general manager (Mr. Ellis) and members of his staff for the kind welcome extended to them, for the use of the Council Chamber, and for the generous hospitality which had been extended to them during their stay in Cardiff. A vote of thanks to the President and to the Hon. Secretary (Mr. C. J. Spencer) concluded the proceedings. After the ordinary business meeting, Mr. Ellis again kindly provided special cars for the members to inspect other interesting points of the system, and these were greatly appreciated.

JUNIOR INSTITUTION OF ENGINEERS.—At a meeting on Friday, May 31st, Mr. Arthur Bourne gave a lecture on the "Standardisation of Engineering Catalogues." He referred to the chaotic conditions under which manufacturers introduced their productions to the notice of consumers, and urged that more care, science and system should be brought into the extremely important question of catalogue production, upon which so much money was spent. Under existing conditions it was difficult to know how to file catalogues, and he doubted if there was a really satisfactory system. What buyers abroad welcomed was literature that gave not only detailed illustrations, but also full and complete information such as net and gross weights, shipping measurements, code words, and approximate prices, so that if necessary, a quotation could be given without having to refer home. It was really surprising what a large percentage of catalogues failed in this respect.

INSTITUTION OF MUNICIPAL ENGINEERS.—This Institution has lately been interesting itself in aviation, and held a meeting at the Hendon Aerodrome this week, at which papers were read on the subject. Mr. B. Wyand, in putting forward suggestions for regulations in relation to aviation, said that the practice of laying overhead wires should now cease; the danger to aviators, even in the daytime, was obvious. Existing overhead wires should be laid underground as speedily as practicable, those at the greatest height being dealt with first. Mr. Wyand's clever paper contains many amusing passages, and we hardly know whether to take him seriously or not; but we can assure him that houses and trees are as likely to be levelled for the benefit of the aviator as electric overhead wires to be laid underground.

ROYAL SOCIETY.—The 250th anniversary of the Royal Society will be celebrated on July 15-19th by an evening reception of delegates at Burlington House, a short commemorative service in Westminster Abbey, a formal reception of delegates in the Great Library of the Royal Society, a dinner in the Guildhall, a garden party at Syon House, and a *conversazione* at the Royal Society's rooms. On July 18th the King and Queen will receive the President, Council and delegates of the Society at Windsor Castle, and the Universities of Oxford and Cambridge will entertain the delegates on the following day.

THE VICTORIAN INSTITUTE OF ELECTRICAL ENGINEERS.—At a meeting in Melbourne on April 25th, a paper on the compulsory licensing of electrical wiremen was read by Mr. H. Smith. To obtain a licence, the writer maintained that a wireman should have served at least five years at practical work, and also passed an examination before a committee.—*M. and E. Review.*

Accident.—A Bellshill, Lanarkshire, boy, who climbed on a roof in search of a ball, caught hold of an overhead electric wire. As a result of the shock, he fell to the ground and was seriously injured.

Inquiry.—Correspondents are asking for the address in this country of Mr. Arthur Allison, of the Cassilis Gold Mines of Victoria.

Errata.—In the article on "Rating of Cables," p. 921, Table I, col. 10, line 23, for 350 read 380; col. 11, line 23, for 353 read 355. P. 953, col. 1, line 33, for 6,800 read 2,800.

Parliamentary.—In the House of Commons on 6th inst., the debate on the second reading of the National Electric Construction Co.'s Bill was adjourned,

Annual Outings.—The employés of the Clyde Valley Electrical Power Co. held their annual outing to Auchenlochan on the Kyles of Bute on Saturday, 8th inst. The outing was graced with fine weather, and was most enjoyable in every way. A large party travelled, all the departments of the works being well represented, and in the course of the afternoon the company's general manager, Mr. D. A. Starr, and his wife, were presented with a solid silver tea service on the occasion of their silver wedding. Provost Johnstone, Rutherglen, presided.

On Friday night last, the staff, employés, and friends of Messrs. Kelvin & James White, Ltd., numbering about 350, had a most enjoyable evening cruise in beautiful weather. By the courtesy of the North British Railway Co., a special train was in waiting for them at Queen Street Station at 6.30 p.m., and the party joined the steamer at Craigendoran, and thereafter proceeded on a cruise up the Kyles of Bute. The outing was, from beginning to end, a complete success, and it is proposed to make it an annual one.

Educational Notes.—The former students of Prof. Henrici, F.R.S., who has retired, after 27 years, from the Mathematical Chair at the City and Guilds Engineering College, have had engraved in his honour a medal to be awarded annually "for proficiency in mathematics."

The Board of Education announces that owing to the complicated questions raised by a general revision of the Regulations for Technical Schools, the existing regulations will be continued in force as regards England during the educational year 1912-3. A circular was issued on June 6th explaining this and other matters relating to Technical Schools.

Flying Tour.—The International Correspondence Schools have arranged for Mr. R. Slack, one of their students, to fly round Great Britain on an 1,100-mile tour in a monoplane, which will afterwards be presented to the nation by the I.C.S.

Appointments Vacant.—Tramways manager for the Ilford U.D.C. (£400). Junior engineer, for the Rochdale Corporation Electricity Department (10s.). See our advertisement pages to-day.

Causes of Fires in U.S.A.—The April issue of our American contemporary, *Insurance Engineering*, contains a very complete account of the campaign that has been in progress in the States for some months past against the pernicious match. The large number of fires due to the use of matches has led to an agitation in certain quarters for legislation controlling their sale and use. One of the articles (by D. W. Sleeper) contains the following comments:—

"There was a time, not so many years ago, when it seemed to be the custom to report the cause of all fires of unknown origin as being due to defective electric wiring. Largely through the efforts of fire insurance and fire prevention interests, drastic rules for the proper installation of electric equipment and the safeguarding of life and property were compiled and their adoption by the different cities secured after long and bitter struggles. To-day we seldom hear of 'defective wiring' fires. Instead, it is now customary to place the blame for unknown-cause fires on rats and matches."

Will the English newspaper Press be so good as to follow the trans-Atlantic lead in this matter?

Electricity Works Table.—Our Electricity Works Table is now in the press; corrections can still be made if received by June 21st *at latest*. Central station engineers and managers who have not already forwarded statistics to date are earnestly requested to do so as soon as possible.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The wedding took place on June 8th, at Ashover, in Derbyshire, of MR. HERBERT BELL, city electrical engineer, Hull, and Miss Millicent Harker Coburn, of Millbrook, New York State, U.S.A.

The Accrington Electricity Committee presented a handsome silver tray to MR. HAROLD GRAY, the borough electrical engineer, on the occasion of his marriage recently to Miss Dinsdale; the staff of the electricity works also presented him with a complete set of cutlery.

The Lancaster T.C. has increased the salary of the electrical engineer by £25 a year forthwith, with a further increase of £25 next year.

With reference to the proposal to increase the salary of MR. P. P. WHEELWRIGHT, borough electrical engineer at Blackburn, from £500 to £700 per annum by four annual increments of £50 each, at a labour meeting held on 6th inst. on the local market place, attended by over 400 people, a resolution was passed as follows: "That this meeting strongly protests against the proposed increase of £200 in the electrical engineer's salary. It was clearly understood, when appointed, that his present salary of £500 should be the maximum. The meeting further asserts that instead of increasing the salaries of already well-paid officials, the Council should devote its attention to increasing the wages of the low-paid workers."

The E.L. Committee of the Bexhill-on-Sea T.C. has recommended the Council to increase the salary of MR. C. A. FROST, assistant engineer, from £175 to £200 per annum.

The Electricity Committee of West Ham T.C. reports the resignation of MR. H. H. COUZENS, electrical engineer to the undertaking, to take up an appointment under Hampstead B.C. Owing to the fact that there are several very important matters pending relating to the undertaking, in which it is essential that the Council should have the advantage of Mr. Couzens's assistance, it has been decided, subject to the Hampstead Council's consent, to retain his services as consulting electrical engineer for a period of one year, at a fee of 200 guineas.

Owing to the resignation of MR. R. V. TASKER, shift engineer to the Sheffield undertaking, MR. T. ROBERTS, at present switchboard attendant, is to be transferred to Mr. Tasker's position, at a salary of £110 per annum.

The E.L. Committee of Torquay Town Council has decided that, having regard to the extra services rendered by the electrical engineer, MR. SALT, in connection with the installation of new plant, and the financial and other improvements effected by him in the working of the undertaking, his salary should be increased from £300 to £350 per annum.

The Warrington T.C. has increased the salary of MR. H. B. JACKSON, chief assistant electrical engineer, from £180 to £190 per annum, rising by £10 next year to a maximum of £200.

MR. P. J. S. TIDDEMAN, late borough electrical engineer at Stoke-on-Trent, has been appointed general manager of the Llanelly and District Electric Light and Traction Co., Ltd.

MR. WALTER G. HURST has been promoted from station superintendent to chief assistant engineer at the Heckmondwike electric light and power station.

Tramway Officials.—The Tramways Committee of the Bradford T.C. recommend that the salary of MR. C. J. SPENCER, general manager, be increased from £700 to £800 by two annual increments of £50, commencing at the beginning of the current financial year.

The Wolverhampton T.C. has been recommended to increase the salary of MR. W. A. LUNTLEY, tramway manager, from £350 to £400 as from May 1st.

The General Purposes Committee of the Southport T.C. have confirmed the following resolution of the Tramways and Electricity Committee:—"That on the report of Mr. Black, electrical engineer and tramway manager, the Tramway Committee are of opinion that there is no necessity for a deputy engineer and manager. The Committee, therefore, although with regret, resolved that Mr. Kendrew be requested to resign his position as from June 25th next, and to accept three months in addition to his salary up to that date."

BAILIE NELSON and COUNCILLOR W. F. RUSSELL, convener and sub-convener of the Glasgow Corporation Tramways Committee along with the general manager and the engineer, are to attend the Biennial Conference of the International Tramways Union at Christiania next month.

General.—MR. HARRY NIMMO has resigned his position as electrical engineer to the Irrawaddy Flotilla Co., Ltd., in order to take up an appointment on the staff of the Rangoon Electric Tramway and Supply Co., Ltd. Before going to Burma, three years ago, Mr. Nimmo was for some time electrical engineer to the Oakbank Oil Co., Ltd. Previous to that, he was on the outside erection staff of the British Westinghouse Co. and in the works of Messrs. Bruce Peebles & Co., Ltd.

MR. W. H. M. BIGGS, secretary to the Adams Manufacturing Co., Ltd., who, as stated in the ELECTRICAL REVIEW last week, is leaving to take up a position with Electromotors, Ltd., Openshaw, Manchester, has been presented by the staff with a mahogany bureau.

CITY NOTES.

Birmingham and Midland Tramways, Ltd.

THE annual meeting of this company was held on Tuesday at Electrical Federation Offices, Kingsway, Mr. C. S. B. Hilton presiding.

The CHAIRMAN, in proposing the adoption of the report (see ELECTRICAL REVIEW, page 934), said that the year had been marked by expansion in both branches of the business, and he thought he might congratulate the shareholders upon a fairly successful year. The total revenue from all sources was £109,901, compared with £102,618 in 1910—an increase of 7 per cent. The expenses for the same period were £52,365, compared with £53,703—an actual decrease of over 2½ per cent. The number of passengers carried on the tramways increased by 600,000, and the proportion of expenses to receipts had been reduced from 63 to 56 per cent. After providing for interest on sinking fund debentures, and paying the 5½ per cent. dividend on the preference shares, placing £5,000 to renewals, against £3,000 in 1910, and £3,750 to reserve, against £1,000 last year, they were able to recommend an increased dividend of 3 per cent., as against 2 per cent. for the previous year. The capital account was increased during the year by £6,211, of which £6,092 was spent upon the electricity supply undertaking and £118 upon the tramways. In order to comply with the terms of the trust deed, £4,803 of debenture stock was cancelled during the year. In the traction section of the business, the traffic receipts had increased by £2,400—over 5 per cent.—and the average profit per route-mile had also expanded satisfactorily, while the expenses showed an actual decrease of £900, chiefly in repairs and maintenance, owing to the heavy expenditure on cars in past years having now been largely overtaken. In the electricity supply branch the sales of current showed a very satisfactory increase in revenue, although the actual number of units sold was less by 1,308,000, owing to the loss of one large consumer at a very low rate. He was glad to say they were gradually overcoming that shrinkage by adding new consumers paying better prices. The balance carried to profit and loss account from the lighting section amounted to £10,410, practically the same as in 1910. They had every reason to be satisfied and hopeful about this side of the business, which continued to show regular and healthy expansion, and they looked with every confidence to the future. He was pleased to be able to say that they neither reduced the tramway service nor disappointed a single customer taking a supply from their Smethwick station, during the recent coal strike. It was important they should bear in mind that the effect of the coal strike would give them considerable anxiety in the future, as not only had the cost of coal gone up, but the price of all other materials had a tendency to rise. Therefore, the working expenses were certain to show an increase, whilst it was very difficult to obtain increased fares or increased rates for electric current. An interesting decision had recently been given by the Court of Appeal in a case brought by the Metropolitan Electric Tramways Co. on the question of the assessment of tramways for the general district rate. If that decision stood, tramways would in the future be entitled to be assessed at one-fourth of the full annual value. That should result in a considerable saving in the item of rates and taxes, which amounted in their case last year to close on £2,300. The interest received on their investments last year amounted to £29,861—an increase of £4,700, due to the greater prosperity of the associated companies. With regard to the City of Birmingham Tramways Co., Ltd., in which they had a large holding, and which company was now in liquidation, they decided to support the directors in their policy of forming a new company to liquidate the assets. The Electrical and Industrial Investment Co. had now been registered, and application had been made on behalf of that company for the ordinary and preference shares and the debenture stock to which they were entitled under the scheme. They were to receive £17,500 of 5½ per cent. debenture stock; £53,772 of 6 per cent. preference shares, and no less than 161,316 ordinary shares of £1 each in the new company. The directors had every anticipation that the result of that investment would be to substantially increase in future the return received on their securities.

MR. J. A. LYCETT seconded the motion, and the report was adopted.

Subsequently a resolution was agreed to changing the name of the company to the Birmingham District Power and Traction Co., Ltd.

British Electric Traction Co., Ltd.

THE directors' report for the year ended March 31st, 1912, which is to be presented at the meeting at the Holborn Restaurant, W.C., on June 20th, has been issued. To it there are appended various schedules, and it is accompanied by a pamphlet giving particulars and statistics of progress for 1911 of the associated companies included in the British Electrical Federation, which is a combination of electric traction, lighting and other companies in which the B.E.T. Co. is financially interested. It is stated that the federated companies have during the year in almost every case again made good progress. The total traffic receipts for the past year amount to £1,770,748, showing an increase of £80,421, compared with 1910, and a satisfactory feature of the development is that the receipts and the passengers carried per route-mile have steadily increased—the receipts having gone up from £3,638 to £3,780 per route-mile, and the passengers carried from 699,043 to 725,321 per route-mile; the total number of passengers carried in 1911 was 339,696,820, as compared with 324,796,450 in 1910. In the electricity supply department substantial progress has also been made; the number of units generated at the power stations of the electricity supply companies was 59,833,512—an increase of nearly 10 per cent. compared with 1910. The net profits of the Associated Companies show an increase of over £85,000, compared with 1910. The amount applied in the payment of interest on debentures and distributed as dividends shows a substantial increase, and the amounts placed to reserve are also larger. The B.E.T. Co. has received £35,060 more interest and dividends from Associated Companies than in 1910. The directors recommend the payment of the dividend for the year upon the 6 per cent. cumulative preference stock. They are of opinion that on the present occasion the best interests of the company will be served by strengthening its position, and they have therefore decided to apply the increased profits to writing down certain items in the balance-sheet by £34,043, and also to place £25,000 to reserve as in the preceding year. In addition to the progress shown by the accounts, the investments and undertakings of the company have in several instances materially improved.

The City of Birmingham Tramways Co. having parted with the whole of its tramways is about to be liquidated, and is returning £4 in respect of each ordinary share of £1. The British Electric Traction Co. ten years ago purchased a large holding at £1 17s. 6d. per share—showing an appreciation of £113,904. These shares now belong to the Birmingham and Midland Co., in which the B.E.T. Co. is largely interested. An investment company with a nominal share and debenture capital of £800,000 has been formed, which will take over the whole of the assets and liabilities of the City of Birmingham Co. The constitution of the company will enable it to carry out much more effectively the business of an investment company than could be done by the City of Birmingham Co., which was originally formed for the purpose of leasing and working tramways, but which, owing to the expiry of the leases and the sale of its tramways, had large sums invested in electrical and other securities. The directors are of opinion that the interests of the B.E.T. Co. will benefit by reason of its connection with the investment company referred to. In the case of the Swansea company, the position has been improved by an agreement which has been made with the Corporation (subject to confirmation by Parliament) for the co-ordination of the varying tenures.

A satisfactory improvement is shown in the profits of the North Metropolitan Electric Power Supply Co., the Metropolitan Electric Tramways, Ltd., the Auckland Electric Tramways Co., Ltd., and the Bombay Electric Supply and Tramways Co., Ltd., the latter company paying its first dividend on the ordinary shares at the rate of 3 per cent. for the year.

During the year the company has taken an important participation in the British Canadian Power Co., which has been formed to develop water-power rights in Canada. The company supplies electric power, compressed air and electric light to the mines and

other consumers in the town of Cobalt and the surrounding districts—one of the richest silver-producing districts in the world.

The directors regret that the Brush Co., in common with other electrical manufacturing companies, is still suffering from intense home and foreign competition, but the volume of business has increased, and prices obtainable are slightly better. It is hoped that the improvement will continue, but a reduction of its capital is unavoidable.

The re-arrangement of the capital of the B.E.T. Co., as proposed by the directors after consultation with a committee of representative shareholders, was confirmed by the proprietors, and the subscribed capital of the company at March 31st, 1912, was £2,947,380, as follows: 6 per cent. cumulative preference stock, £403,592; 7 per cent. non-cumulative preference stock, £807,185; 6 per cent. preferred ordinary non-cumulative stock, £1,070,097; deferred ordinary stock, £666,505. The debenture stock outstanding at the same date was, £1,895,632, namely, 5 per cent. perpetual debenture stock, £1,461,575; 4½ per cent. second debenture stock, £434,057. During the year the directors purchased in the market and cancelled £2,670 5 per cent. perpetual debenture stock and £5,539 4½ per cent. second debenture stock of the company. The outstanding debenture stocks have been reduced by these amounts, and the difference of £1,323 between the nominal value and the purchase price has been added to reserve.

The reserve at March, 1911, was £666,332. This amount has been increased by £2,832 net profit on sale of investments and by £1,323 above referred to and also by £25,000 transferred out of the profits of the past year. The reserve has been debited with £11,119 loss on sale of Consols, and with £60,636, which has been written off various investments by reason of reductions of capital. The balance at credit of this account is now £623,733. Having dealt with the depreciation of all assets other than investments and undertakings, the whole of the reserve becomes available for depreciation of this item, and the directors have shown the reserve in the balance-sheet as a deduction from the amount at which the investments and undertakings stand in the books. They will continue to add to the reserve all profits made by realisation of the investments and charge against the reserve any losses on realisation. The Associated Companies have created depreciation and other reserve funds of their own, which amounted at December 31st, 1911, including the balances carried forward, to £1,124,998. The reserve of £502,446 of the City of Birmingham Tramways Co., shown in last year's schedule, has been reduced by £300,278, which has been applied in writing down the property account. The amount now standing to credit of the reserve of that company is £202,264, which represents the surplus of assets over its capital and liabilities.

In regard to investments and undertakings, this item, after deducting the reserve for depreciation above referred to, stands at £4,695,103, and consists of shares and debentures in associated tramway, electricity supply, manufacturing and other companies, Consols, and sundry securities and undertakings. The yield for the past year on the total investments and undertakings standing in the books at £5,318,836 was 3·32 per cent., compared with 2·7 per cent. for the preceding year on £5,204,667; and the yield on the total at which the investments and undertakings stand, after deducting reserve, is 3·77 per cent.

The gross profit for the year amounted to £195,041, as compared with £166,108 for the year 1910-11. After deducting management expenses and other charges amounting to £19,064, there remains a balance of £175,977, to which must be added £10,832, the amount brought forward making £186,809, from which has to be deducted debenture stock interest amounting to £92,799, leaving a balance of £94,010. The total amount placed to reserve or written off is £59,043, and the dividend of 6 per cent. on the cumulative preference stock for the year ended March 31st, 1912, on account of which an interim dividend of 3 per cent. has already been paid, amounts to £24,216, leaving £10,751 to be carried forward.

Since the last ordinary general meeting of the company Sir Charles Rivers Wilson and the Hon. Sir Charles W. Fremantle have resigned their seats on the board, and after consultation with the committee of representative shareholders, the directors appointed Mr. G. T. Symons and Mr. C. G. Tegetmeier to fill the vacancies, subject to confirmation by the shareholders. The directors who retire this year are Mr. C. Shirreff Hilton and Mr. William L. Madgen, and they will be proposed for re-election.

Continental. — Germany. — The Braunschweig-Hannoversche Uberlandcentrale A.G., Berlin, has been formed for the generation and supply of electrical energy in the province of Hannover and the Duchy of Brunswick, and neighbouring districts, with a capital of 1,000,000 marks. The Bergmann Elektricitäts Unternehmungen A.G. are the founders of the company.

The Wilhelmshaven Strassenbahn G.m.b.H. is the style of a company formed at Frankfurt a/M. to build and work tramways, &c., in Wilhelmshaven.

France.—The balance-sheet of La Société Electro-Metallurgique Française, of Froges (Isère), for the last financial year, shows a net profit of £85,583, as compared with only £72,767 in the preceding 12 months.

Western Telegraph Co., Ltd. — The directors have declared a third quarterly interim dividend of 3s. per share, free of income-tax, for the year ended June, 1912, being at the rate of 6 per cent. per annum. The transfer books will be closed from June 17th to 22nd.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to :—

County of London Electric Supply Co., Ltd.—Further issue of 19,000 ordinary shares of £10 each, fully and partly paid (No. 80,001 to 29,000).

And to allow the following securities to be quoted in the Official List :—

Tramways (M.E.T.) Omnibus Co., Ltd.—Fully-paid scrip for £100,000) 4½ per cent. guaranteed debenture stock.

The Committee have appointed special settling days as under :—

Wednesday, June 19th.—Sudd Fuel (Suddite), Ltd.—75,400 7 per cent. cumulative participating convertible preference shares of £1 each, 15s. paid (Nos. 1 to 75,400).

Thursday, June 20th.—Marconi Wireless Telegraph Co. of America.—Temporary certificates for 2,000,000 shares of $5 each, fully paid.

Vancouver Power Co., Ltd.—Scrip, fully paid, for £800,000 4½ per cent. perpetual guaranteed debenture stock.

And ordered the undermentioned securities to be quoted in the Official List :—

Consolidated Gas, Electric Light and Power Co. of Baltimore.—Further issue of $250,000 general mortgage 4½ per cent. 30-year gold bonds of $1,000 each (Nos. 9,833 to 9,932 and 10,083 to 10,232).

South American Light and Power Co., Ltd.—£150,000 5 per cent. registered debentures of £100 each (Nos. 1 to 1,500).

Vancouver Power Co., Ltd.—£800,000 4½ per cent. perpetual guaranteed debenture stock.

Manila Electric Railroad and Lighting Corporation.—The directors' report (as abstracted in the *Financial News*) shows that the gross earnings for the year ended December, 1911, were $1,452,688, an increase over the previous year of $135,659, or 10·30 per cent.; operating expenses and taxes increased $30,680, or 5·02 per cent., while the net earnings from operation were $810,849, an increase of $104,979, or 14·87 per cent. Interest charges during the year were $277,092, and sinking fund requirements were $27,933, leaving surplus earnings for the year of $505,825. The directors increased the annual appropriation for the replacement and renewal fund from $60,000 to $80,000, and, deducting this from the year's surplus earnings, leaves an available surplus for the year of $425,825. From this amount there were paid three dividends of 1¼ per cent. each and one dividend of 1½ per cent., aggregating $262,500, leaving $163,325 over all disbursements and reserves, which has been transferred to surplus account, making the total accumulated surplus with reserves at December 31st, 1911, $1,080,078, an increase over 1910 of $329,953. During the year there were purchased by the trustee under the sinking fund provisions of the company's mortgage, $31,000 face value of the 5 per cent. 50-year first lien and collateral trust sinking fund gold bonds, making a total of $119,000 face value of bonds held by the trustee at the end of 1911. The directors have authorised for 1912 the construction of about 5½ miles of track on other city streets not at present occupied, an addition of 800 H.P. in boiler capacity, and an addition of nine cars to the rolling equipment, of which three have already been purchased and six will be built in the company's shops. The foregoing will require an expenditure of over $200,000. Dividends have been paid as follows: 1906, 3 per cent.; 1907, 3 per cent.; 1908, 4 per cent.; 1909, 4 per cent.; 1910, 4 per cent.; 1911, 5¼ per cent. Since the beginning of the current fiscal year there has been added $31,000 face value of the 5 per cent. 50-year first lien and collateral trust sinking fund gold bonds to the sinking fund, making the total bonds in that fund $150,000.

Swedish Telephone Companies.—The Stockholm Allmänna Telephon A.B., which is largely interested in telephone companies in Stockholm, Moscow, Warsaw and Mexico, and which carried out large telephone installations in Russia in 1911, reports net profits of £252,000 for that year, as compared with £208,000 in 1910, on a share capital of £313,000. It is proposed to pay a dividend of 37 per cent., this rate contrasting with 33 per cent. in 1910. The L. M. Ericsson Co., which has a share capital of £373,000, earned net profits of £159,000 in 1911, as contrasted with £93,000 in the previous year, and intends to distribute 14 per cent., as against 12 per cent. in 1910. The company owns telephone factories in various countries, and is also interested in factories in other countries.

Gwynnes, Ltd.—The directors report that the accounts for the year to January 31st show (says the *Financier*) that after providing for debenture interest, writing £18,750 off for depreciation of buildings, plant, &c., the debit balance of £7,432 brought forward was increased to £20,614.

Electric and General Investment Co., Ltd.—The directors, subject to the completion of the audit, recommend the following dividends for the year ended May 31st: Ordinary shares, the full dividend of 2s. per share, being 10 per cent. per annum on the capital paid up: deferred shares, a dividend of 6d. per share. Both are subject to deduction of income-tax. It is proposed to add £3,075 to the contingencies fund, raising the amount standing to the credit thereof to £82,000, carrying forward £2,726.

Canadian General Electric Co.—The directors have declared a quarterly dividend on the common stock for the three months to June 30th at the rate of 7 per cent. per annum.

Globe Telegraph and Trust Co., Ltd.—The directors have declared final dividends of 3s. per share on the preference and 6s. on the ordinary shares. £28,000 is carried forward.

Siemens Brothers & Co., Ltd.—The directors have declared a dividend of 4 per cent. (4s. per share) for the year ended December 31st, 1911. The annual meeting was held yesterday in London.

United Electric Tramways of Montevideo, Ltd.

THE directors' report for the year ended March 31st, 1912, gives the following table of results of the operation of the tramways for the year to October 31st, 1911 :—

	1910-11.	1909-10.	Increase.
Gross receipts	$1,403,200	$1,315,955	$87,245
Operating expenses	794,692	781,994	62,698
Net receipts	$608,508	$533,961	$24,547
At Exchange of $4·7 to the £	£129,470	£124,247	£5,223
Passengers carried	34,662,138	32,474,355	2,187,783
Car-miles run	6,358,057	6,185,737	172,320
Percentage of operating expenses to gross receipts ..	56·63	55·62	1·01

The results are considered satisfactory when account is taken of the loss of traffic and increase in working expenses arising out of the disturbances in May, 1911. The increase in rates of wages granted by the company came into operation during the second half of the year, and the effect of the permanent addition to the labour charges is not fully shown in the above figures.

The extension of the lines to the suburb of Maldonado was completed during the year, and a further extension of approximately two miles from the existing terminus at Colon is now being constructed. The latter extension completes the lines required by the company's concessions. The enlargement of the hotel at Pocitos was finished by the end of 1911, in time for the summer season, but after the closing of the accounts for the year. The growth of the business has necessitated the provision of larger premises for the administration and office staff, and the company are erecting a new building for this purpose in one of the principal streets in Montevideo. Part of the building will be occupied by the offices of the company, the remainder being let as public offices. The large increase in the volume of traffic has made it essential to provide additional rolling stock, and 25 new cars have recently been ordered for delivery in Montevideo in time for the next summer season. It is anticipated that further expenditure will be required in the near future for the extension of the power plant.

The amount received from La Sociedad Comercial de Montevideo in respect of dividend and interest was £126,544. The profit and loss account for the year, after providing for administration expenses and charging £44,575 for debenture interest, shows a credit balance of £79,178. To this must be added the balance of £13,755 brought forward from last year, making a total to be dealt with of £92,933. There has been set aside for the purpose of the debenture stock redemption fund £2,675, and transferred to renewals and contingency account £25,000. The preference dividend of 6 per cent. per annum and one of 8 per cent. per annum on the ordinary shares, leave £13,467 to be carried forward. The meeting is called for to-day at Winchester House, E.C.

Woking Electric Supply Co., Ltd.

A GOOD deal of fault-finding was indulged in by shareholders at the annual meeting of this company on Saturday afternoon, arising from the fact that the dividend on the ordinary shares had dropped from 5 per cent. to nil. Mr. John Ashby (chairman) presided.

The directors reported that the revenue for 1911 was £14,475, and the expenditure connected with the generation and distribution and management £7,666, leaving a balance on the year's working of £6,809, plus £499 brought forward and £61 income-tax accumulations, making a total of £7,370. This they proposed to appropriate as follows :—Interest on the 4½ per cent. debentures, £2,176 ; interest on temporary loans, £853 ; dividend on the 6 per cent. cumulative shares, £2,361 ; depreciation and renewals fund, £1,250 ; reduction of various capital expenses, £166 ; leaving a balance to be carried to the net revenue account of £562. Progress during the past six years had been as follows :—

	Consumers.	Lamp connected.	Revenue.
1905..	880	33,735	£11,476
1906..	1,003	40,030	12,296
1907..	1,109	45,305	14,130
1908..	1,225	51,070	14,452
1909..	1,348	55,089	13,740
1910..	1,496	62,293	13,785
1911..	1,628	70,710	14,134

During the year the directors had issued £400 4½ per cent. debenture stock, and £2,030 6 per cent. cumulative preference shares, and, owing to the continuous growth of business, they were looking towards issuing further debenture stock, preference and ordinary shares. The capital expenditure to date had been £130,701, and during the past year 6½ miles of cable had been laid. The sale of apparatus for domestic purposes showed a steady advance.

The CHAIRMAN, in moving the adoption of the report, said the increase of £349 in the revenue, as compared with 1910, occurred mainly during the latter part of the year. It was not till then that they really overtook the loss that had been occasioned by the introduction in 1909 of the metal-filament lamp. The suggestion had been made that they should increase the price of current, but the directors decided that this would not be wise. Referring to the continued growth of business, the speaker said the company delivered 13,042 units for the week ending the 6th inst., as against 10,611 for the corresponding week last year. Owing to the railway strike, coal cost £265 more last year than in 1910, and rates and taxes were up £65. They were still experiencing trouble in regard to their coal supply, and the directors had come to the conclusion that it would be to the advantage of the company if they partly replaced coal with oil, and introduced the Diesel engine into their works. They had asked their colleague, Mr. Bowden, to look into the matter, and if his report was satisfactory, they would probably put down an engine of this type, for which £2,000 or £3,000 further capital would be required

MR. STRATHERN said it seemed very strange that, with an increasing revenue, the company should be unable to pay any dividend this year on its ordinary shares after paying 5 per cent. Was that office and shop a financial success or otherwise? And why were the other premises vacated when the directors knew the metal-filament lamp was going to affect the company adversely? He suggested that there was something wrong with the management, and that the sooner they got the late manager reinstated the better.

MR. BERRY asked if the increase of £349 in the revenue was the result of the 6½ miles extension of cables, because if so it did not seem a very profitable investment.

DR. WYATT-SMITH said that nearly all the neighbouring companies were doing better than they were, and Guildford was paying 5 per cent. That company seemed everlastingly to have been trying for new business when they did not make good business of that at hand. By endeavouring to run the concern without a technical manager they were making themselves a laughing-stock. He was told that their machinery was antiquated, and that they ought to have had a Diesel engine years ago. By opening the shop and competing with local tradesmen, they had made powerful enemies, and, if proper accounts were submitted, he believed they would show a loss. After 15 years' working the company ought to show at least some dividend on its ordinary shares.

MR. SAVAGE asked who was managing the concern now, and what were his qualifications? It seemed to him that if things were to improve, they must have a shrewd and far-seeing manager.

In reply, the CHAIRMAN agreed that it was hard that the ordinary shareholders should get nothing this year, but pointed out that 75 per cent. of the ordinary shares were held by the directors, who, while dissatisfied at getting no dividend now, were fairly satisfied as to the future. Those premises, in the opinion of the board, were quite a success, and had answered all their expectations. They sold a great deal of apparatus which increased their output of current. With regard to management, in the place of their late manager, they now had three superintendents, one at the works, one for the mains, and another for wiring ; and, in the opinion of the directors, this arrangement was working very satisfactorily. Moreover, they had on the board the general manager of one of the largest electric light works in London.

MR. SAVAGE : Were these officials with the company while Mr. McLean was manager?—The CHAIRMAN : Yes, but not in their present capacity.

Proceeding, the CHAIRMAN said the existing machinery was of the most up-to-date type, and it took 12 months for new cable to earn money.

MR. STRATHERN wished to move that discount on promptly-paid bills be discontinued.

MR. KILBY : That is virtually raising the price of current.

The CHAIRMAN said the matter was one for the directory. He would sooner reduce the price than raise it.

The report and accounts were then adopted.

Marconi Wireless Telegraph Co., Ltd.

THE directors, in submitting their report for the year ending December 31st, 1911, deal also with the important developments of the first five months of this year. A circular issued in March stated that satisfactory terms had been settled between the Postmaster-General and the company for the construction of all the long-distance wireless stations required within the next few years for the Imperial wireless scheme. Ten per cent. of the gross receipts of so important a commercial telegraphic service must represent to this company a very considerable revenue for many years to come. All the stations to be erected under this Imperial scheme will be fitted with the latest duplex invention of Mr. Marconi, and also with apparatus for automatic transmission and reception, under which conditions the company guarantees a speed of not less than 50 words per minute, which under favourable conditions should be considerably exceeded. All the long-distance commercial stations which the company will be erecting in the future will be fitted with similar apparatus for automatic transmission and reception.

During 1911 the gross trading profit amounted to £214,407, as compared with £127,453 for 1910, and the net profit was £141,717, as compared with £60,513. But for the fact that the company's business completely outgrew the capacity of its Chelmsford works, delaying the completion until this year of much of the work pertaining to 1911, the figures would have been even more satisfactory. The amount due from the Marconi Wireless Telegraph Co. of Canada, Ltd., was reduced during 1911 from £163,866 to £78,588. This figure is likely to be increased during 1912, as this company will render for the present the financial assistance which is required by the Canadian company for its development. In the balance-sheet "patents and shares in associated companies" are again taken into account at their cost price, with the exception of Spanish shares, which are taken at their par value. The company's shareholdings have been reduced by the sale of 50,000 Canadian shares at 15s. per share, and the redemption by the International company of £40,000 debentures at par, and increased by the addition of Spanish, Russian, and French shares. The company now holds shares in associated companies of a total par value of £2,074,724, many of which are quoted at a premium.

The new 250,000 ordinary shares of £1 each were issued at £1 per share premium, of which £99,072 was paid during 1911, the balance falling due on or before June 1st, 1912, thus increasing the premium account to the end of 1911 to £105,702, which figure in the next balance-sheet will be increased to £256,630. To the extent of three-quarters of the issue these shares were offered to

the shareholders; the remaining 25 per cent. were dealt with at the same price and served to guarantee the issue without cost to the company. The acquisition of the patents of the Lodge-Muirhead Syndicate has further strengthened the company's patent position.

In October last the control of the Russian Company of Wireless Telegraphs and Telephones was acquired, and, it is expected, will commence to pay substantial dividends in the early future.

The Compania Nacional de Telegrafia sin Hilos has completed its first chain of stations.

The company entered into an engagement to obtain a quotation and settlement in the shares of the Compania Nacional de Telegrafia sin Hilos. Owing, however, to the difficulties which arose through the shares of that company being 500 pesetas each, the Spanish and General Wireless Trust, Ltd., was formed, enabling those who so desired to convert their shares in the Spanish company into shares of £1 each in the Trust company, facilitating the fulfilment by the company of its obligations.

The Belgian company has declared a dividend for the year ending December, 1911, amounting to 50 fr. per capital share (10 per cent.), and 24 fr. per founder's share.

The French company has declared a dividend for the past year at the rate of 5 per cent. per annum.

The Marconi International Marine Communication Co., Ltd., is about to declare a dividend at an increased rate for the year ending December 31st, 1911.

The Deutsche Betriebsgesellschaft fur Drahtlose Telegraphie m.b.H. (Debeg), in which this company is interested through its Belgian company, has declared its first dividend of 4 per cent. for the year ending September 30th, 1911.

The Marconi Wireless Telegraph Co., of Canada, continues to show satisfactory progress. Negotiations for a further contract with the Government have been pending for some time. The terms have now been practically agreed, and the contract is likely to be executed at an early date.

Circumstances have delayed somewhat the proposed developments of the Argentine company. A representative of this company, however, is now in Buenos Ayres.

Progress of the greatest importance has been made in the United States of America. For some years past the American company was able to transact but a comparatively small business owing to the severe competition to which it was submitted by the United Wireless Telegraph Co. The business methods adopted by that company were such as to render effective competition impossible unless business were to be conducted at a substantial loss. There was, however, no doubt that the United Wireless Co. was infringing the patents of this company, and proceedings at law were therefore commenced. The chairman and managing director proceeded to New York, accompanied by Mr. James Swinburne, F.R.S., to give evidence on behalf of the American company, the case having been fixed by the Judge to be heard on March 25th. Following the prosecution and subsequent conviction of the directors of the United Wireless Telegraph Co., the business was being conducted by trustees under the Court, pending the completion of the arrangements which were in course by a shareholders' re-organisation committee. As a result of negotiations, agreements were eventually entered into by which this company acquired the whole of the tangible assets both in and out of the United States of the United Wireless Telegraph Co. These assets in so far as they related to the United States of America, were re-sold to the Marconi Wireless Telegraph Co. of America. The United Wireless Telegraph Co. acknowledging the validity of the Marconi patents, and admitting the infringement, judgment and a perpetual injunction were granted by the Court. The business is now being directed by the Marconi Wireless Telegraph Co. of America, and for their account as and from March 31st last. Arrangements are in progress for the transfer to this company of the property out of the U.S.A. possessed by the United Wireless Telegraph Co., and judgment by consent in favour of this company will be taken in the actions pending against the United Wireless Telegraph Co. in our High Courts of Justice. The satisfactory ending of this litigation together with the acquisition of the tangible assets of the United Wireless Telegraph Co. is of the greatest importance. It should at once convert the business of the American company into one of considerable magnitude, controlling all the coast stations of importance on both the east and west coasts, besides practically the whole of the American Mercantile Marine at present fitted with wireless telegraphic installations. It may be reasonably anticipated that this business alone should prove sufficiently remunerative to enable the payment of dividends even upon the largely increased capital. A considerable impetus, however, to the ship and shore business in the United States is to be expected from recent events by the extension of the scope of the existing law rendering wireless telegraphy compulsory upon practically all vessels.

During the visit of the chairman and managing director to New York, a further agreement of great significance and importance was entered into with the Western Union Telegraph Co. and the Great North-Western Telegraph Co. This agreement, *inter alia*, furnishes the Marconi Co. with some 25,000 telegraph stations for the delivery and despatch of Marconigrams throughout the United States and Canada. The agreement enables this company in conjunction with the American company immediately to embark upon the erection of the stations which will open up by wireless improved and cheaper telegraph services to all these parts of the world, fulfilling an important section of this company's programme.

The stations to be constructed by the American company necessitate a large expenditure. It was, therefore, resolved to increase the capital of the American company to $10,000,000, and to split the existing shares of $25 into shares of $5 each. By the laws of the State of New Jersey, any increase of capital must in the first instance be offered to shareholders. It was not contemplated that the shareholders would have taken more than a small proportion of the total number, and this company had undertaken to place whatever number of shares there remained unsubscribed. The total $7,000,000 was, however, subscribed in cash, and is available for the construction of a large number of stations and the development of a very extensive telegraph service.

Arrangements are now in progress, and the work will be carried out as expeditiously as possible, for the construction of stations placing this country in direct communication with New York, instead of, as at present, passing through the company's station at Glace Bay, for the construction of stations at San Francisco communicating through the Hawaiian Islands to the Philippines, China and Japan, and from New York south to Cuba, Panama, and, subsequently, with each of the South American States. Each of these stations when completed should ensure to the American company, as well as to this company, a very considerable revenue.

An important contract has recently been entered into, provisionally, with the Portuguese Government. The directors hope to be in a position to give fuller information at the general meeting.

The Coltano (Italy) long-distance station was opened in December of last year, and is working most satisfactorily with the Italian Colonies on the East Coast of Africa.

The trans-Atlantic service has continued to work satisfactorily. From May 1st, 1912, all the postal telegraph offices throughout the United Kingdom have been opened for the reception of messages, "*via* Marconi," to any part of the United States of America and Canada. The company has now the use of a private line from eight at night until eight in the morning, by which it is able to send its messages directly from its office in the Strand to the Clifden station, thus materially curtailing the delays which occur on the landlines. It is hoped that the use of a private line in the day time will be obtained shortly. There has been a considerable increase in the number of commercial messages and in Press work, many thousands of words being dispatched every day from London to the New York Press.

The successful development of the company has brought into prominence a large number of inventions and patents in connection with wireless telegraphy, most of which, if not all, are first offered to this company. A staff of able engineers, under the direction of Mr. Marconi, are employed in examining carefully every patent specification which has any connection with wireless telegraphy, and a practical test is made of every device or system for which patent application is made, or which is submitted to this office.

The company makes a point of keeping itself very well informed in these matters, and is at all times prepared to pay reasonably for anything new and of value which comes to its notice.

It has entered into arrangements by which it obtains the sole rights of the world of the wireless compass invented by Messrs. Bellini & Tosi. This invention will be worked in conjunction with existing wireless telegraphic installations on board ships, and will define the position of an approaching ship or of land in a dense fog, thus eliminating a further danger, and, perhaps, one of the greatest to which navigation is subjected. Active steps are now being taken for the commercial development of this process.

Since the last report further valuable patents tending to further perfect wireless telegraphy have been applied for by Mr. Marconi on behalf of this company.

The report refers to the *Titanic* disaster, which, it says, brings us nearer to the day when ships of every nation will be compelled to carry wireless telegraph apparatus. The report continues: It may not be out of place here to refer to the general fallacy of which one has heard so much in recent times respecting the so-called tapping of wireless messages, and to remind shareholders that, under the Berlin Convention of 1906, it was agreed by all the nations who are adherents to that Convention, that ships at sea must be at attention on a wave-length of 300 m., and that conversations between ships at sea and coast stations shall be carried on by the use of wave-lengths of either 300 or 600 m. The very object of this international law is that in case of distress or otherwise every ship at sea shall be capable of calling or being called by any other ship at sea or any coast station, thus, every ship is necessarily able to overhear any other vessel or station within range. This, however, applies to ship communications only. Mr. Marconi's famous No. 7,777 patent enables stations to tune to any wave-length by simple means, and only stations tuned to the same wave-length can communicate together.

Owing to the continuous and considerable development of the company's business, the Chelmsford factory has been kept at work night and day, but has proved totally incapable of coping with the continued increase of business. The directors have found it therefore incumbent upon them to purchase some 10 acres of freehold land close to the Great Eastern Railway, and erect thereon new works capable of the output which is required of them. The machinery is now in course of being installed, and it is hoped within a few days to be in full occupation.

During last year interim dividends were declared at the end of June and the end of December amounting in all to 7 per cent. on the preference shares and 10 per cent. upon the ordinary shares. The directors recommend the payment of a final dividend of 10 per cent. for the year 1911, to which all classes of shares will be entitled. The directors will continue the policy adopted last year of declaring interim dividends pending the preparation of the balance sheet, and in view of the fact that the actual business in hand at this time last year was represented by orders amounting to £254,000, whereas to-day the amount considerably exceeds £1,000,000, the directors feel that they will be adopting a sufficiently conservative policy in declaring 7 per per cent. on the preference shares and a first interim dividend of 10 per cent. on the ordinary shares as against the 5 per cent. of last year, thus leaving preference and ordinary shares to participate equally in all further distributions for the current year.

STOCKS AND SHARES.

Tuesday Evening.

ONCE more the railway position has dominated a good many of the markets in the Stock Exchange, and the shadow of the transport strike hangs over everything. Writing on Tuesday night, it is difficult to do more than generalise, and to refer to the grave

uneasiness which still exists. The Stock Exchange, however hopes that the masters will make a firm stand, and see the thing through. Even members known to have Socialistic sympathies have been heard to endorse this view, on the ground that a straight fight to a finish is better than a constant series of outbreaks to which there seems to be no finality. In the meantime, however, uncertainty makes for decreased business and sagging prices. The wonder is that quotations have not given way much more in the circumstances.

The Home Railway market is reasonably firm, considering all things. A smart drop in Brighton Deferred was partially recovered, and it is understood that underwriters of the new issue—the money being required mainly for the purpose of further electrification—were relieved of their responsibilities. Districts suffered a sharp setback, the price falling a couple of points regaining ½ later. Underground Electric Railways fell ¼, and the income bonds 1, while Metropolitans went back 1¾, although the Surplus Lands stock gained a point. Central London issues lost part of their previous week's recovery; City and South London added 1 to its earlier 4-point rise. There has been further demand for London United Tramways Preference, and the price gained ½. On the other hand, British Electric Tractions are dull, falls of 1 being recorded in the Deferred stock and in the 7 per cent. Preferred. East Londons from 8¾ fell back to 8, from which there was a slight rally.

The shrinkages that have occurred in most of the speculative departments during the past few weeks are making their influence felt in some of the investment markets as well, the invariable result of over-speculation being that holders of sound securities have to realise some of them in order to meet their differences. For this cause, there is a certain amount of weakening in a few of the English Electricity Supply shares, although the effect on prices is comparatively small. Falls of £2 in City of London Ordinary and of £1 in the Preference are the result of sales by tired bulls, who bought the shares originally in the hope of much higher prices being reached. Incidentally, exception may be taken to the practice of sending out these two quotations with a margin of £2 between buying and selling prices, inasmuch as there is almost always a margin of no more than 10s.—at all events, in the case of the Ordinary. This, however, by the way. Amongst the other shares, London Electrics are down to 30s. middle, which makes it look as though our surmise of a possible overhanging block of shares may be near the mark. Westminsters eased off to the extent of ¼, but Counties are very steady. In such times of unsettlement as these, it is impossible to expect any market to go ahead with any degree of assurance.

The demand for Anglo-Argentine Tramways, which has recently raised the prices of the first Preference and the Debenture stocks, is now being turned to the company's second Preference, a further rise of $\frac{1}{16}$ being scored this week. The 4 per cent. Debenture rose 1, but the 5 per cent. lost an equal amount. The Mexican group is unusually quiet, prices showing very little change. Rio Trams went back 1¼ on sales by some of the speculators with big profits to take, but further buyers came along, and put up the price 2 points. Sao Paulo Trams, after their huge rise, receded 2. Mexico Trams fell 1, but the Mexican Light and Power issues are firm, and Monterey Debenture hardened a little. As a reflex to the insurrection difficulties in Mexico, Cuba has also developed a revolution, and although the matter seems to be very much a storm in a tea-cup so far, the stocks and shares of companies operating in Cuba are mostly weak, which has its effect upon other things as well. British Columbia Electric Preferred went back 2 after its rise of last week. Madras Tramways Debenture is 1 to the good. An important scheme is on foot in regard to certain of the tramway companies in the Argentine Republic, but to mention details at present would be premature.

Telegraph descriptions are little moved by the considerations which have made other markets weak. Eastern Ordinary went back a point, but Anglo-Americans are good. American Telephone and Telegraph put on ½, and Anglo-American Telegraph Preferred gained the same amount. To give an idea of the tenderness of investment shares, it may be mentioned that Western Telegraphs fell ½ on the sale of no more than 30 shares. West Coast of American Debentures are firmer, but West India and Panama Ordinary receded a little.

Marconis are jumping about in their usual volatile style. The report which came out this week has been received with mixed feelings, possibly because the figures are so vast that it is difficult to gain a fair view of them. At first the price went down, and on the week the loss amounts to 17s. 6d., both as regards the Ordinary and Preference. So far as the former are concerned, the present price of 5¼ appears to be full value, as things stand now, and the 7 per cent. Participating Preference at 5 middle look much the better bargain of the two. Canadian Marconis went back to 23s. 6d. and Americans to $1\frac{15}{16}$, the special settlement in the last-named having been officially fixed for the 20th inst.

The opening of the arbitration between the National Telephone Company and the Government resulted in a loss of 2½ in the price of the company's Deferred stock. The claim of £20,000,000 is regarded by some people as a good round sum, pretty to talk about, but not at all likely to be realised. The company's Third Preference shares, however, are $\frac{1}{16}$ higher.

Manufacturing issues are mainly quiet. British Thomson-Houston Debenture has risen 3 points, while British Westinghouse descriptions are easier. The substantial rise in the price of copper has had no influence upon industrial shares; and the Rubber share market is dull, without there being much pressure to sell.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	June 8	3,186	— 19	..	..	..	14·4	..
Ayr	„ 8	621	— 16	8	1,048	— 87	8	..
†Bath	May 29	2,112	+1,189	22	18,085	+ 1,692	14·75	..
Birkenhead	June 9	2,531	— 52	10	11,201	— 587	13·68	..
Birmingham Corp.	„ 1	22,871	+8,476	9	94,723	+28,198	57·17	..
Blackburn	„ 5	2,764	— 95	10	12,895	— 98	14·62	..
Blackpool Corp.	„ 6	5,523	+1,932	..	14,117	+ 2,248	11·87	..
Blackpool-Fleetw'd	„ 8	2,768	— 615	22	10,311	+ 535	8	..
Bournemouth	„ 5	4,117	+ 174	9⅔	17,502	+ 762	21·96	..
Bradford	„ 1	12,824	+1,888	9	51,377	+ 1,014	56	1·2
Brighton	„ 9	2,155	— 250	10	9,913	— 531	9·5	..
Bristol	„ 7	16,799	+1,013	..	149,273	+12,894	30·5	..
Brit. Elec. Trac. Co.								
Airdrie	May 31	619	+ 150	22	6,225	+ 1,536	3·65	..
Barnsley	„ 31	414	+ 32	„	3,571	— 298	..	..
Barrow	„ 31	978	+ 894	„	7,520	+ 2,058	5·37	..
Devonport	„ 31	1,215	+ 184	„	11,509	+ 1,770	8·85	..
Gateshead	„ 31	2,215	+ 96	„	21,797	— 51	11·35	..
Gravesend	„ 31	508	+ 70	„	4,442	+ 295	6·5	..
Greenock	„ 31	1,784	+ 95	„	16,600	+ 2,194	7·25	..
Hartlepool	„ 31	672	+ 104	„	5,432	+ 458	6·72	..
Kidderminster	„ 31	428	+ 203	„	2,313	+ 286	..	..
‡Leamington	„ 31	499	+ 167	„	3,429	+ 351	..	..
Merthyr	„ 31	487	+ 72	„	3,978	— 280	2·9	..
Metropolitan	„ 31	20,815	+1,959	„	183,492	+11,157	22	..
Middleton	„ 31	815	+ 44	„	6,883	+ 88	3·5	..
Mid. Joint Com'tee	„ 31	8,510	+2,360	„	68,733	+ 5,454	..	..
Oldham—Ashton	„ 31	1,433	+ 241	„	12,980	+ 1,025	9·13	..
Peterborough	„ 31	316	+ 67	„	2,622	+ 1,025	5·31	..
Potteries	„ 31	4,202	+ 574	„	33,358	— 2,157	22	..
Rothesay	„ 31	406	+ 17	„	2,025	+ 111	2·75	..
Southport	„ 31	867	+ 157	„	6,885	+ 235	8·17	..
S. Metropolitan	„ 31	2,482	+ 195	„	17,711	+ 875	..	..
Swansea	„ 31	2,762	+ 477	„	23,976	+ 682	12·5	..
Tynemouth	„ 31	760	+ 260	„	4,045	+ 263	3·75	..
Weston-s-Mare	„ 31	493	+ 218	„	1,370	+ 185	3	..
‡Worcester	„ 31	735	+ 123	„	5,786	+ 151	5·75	..
Wrexham	„ 31	258	+ 47	„	2,327	+ 274	..	..
Yorks. Wool. Dist.	„ 31	2,575	+ 359	„	23,022	+ 966	17	..
Miscellaneous	„ 31	572	+ 82	„	3,710	+ 220	..	..
Burnley	June 8	3,063	+ 49	..	..	..	11·73	..
Burton-on-Trent	„ 9	598	— 85	10	2,540	— 20	9·7	..
Bury	„ 9	2,763	— 117	10	13,470	+ 5	22·5	..
†Cardiff	May 25	2,879	— 2	8	16,646	— 2,424	17·35	..
Chatham and Dist.	June 6	1,933	— 205	23	18,481	+ 85	14·95	..
Cork	„ 6	1,098	— 162	23	10,594	— 202	9·89	..
Croydon	May 31	4,208	+ 492	..	14,475	+ 533	11·6	·75
Darlington	June 8	477	+ 6	10	2,161	+ 33	4·87	..
Darwen	„ 7	602	+ 8	10	2,809	+ 52	4·36	..
Dover	„ 1	585	+ 43	9	2,084	— 27	4·75	..
Dublin	„ 7	11,944	—1,765	..	128,180	+ 5,724	54·25	..
East Ham	„ 8	2,187	— 286	10	10,668	— 4	7·87	..
Exeter	„ 7	774	— 44	10	3,210	— 216	5·5	..
Glasgow	„ 8	38,776	—3,000	1	22,936	— 1,073	98	·25
Hastings	„ 6	2,210	— 341	..	..	..	19·3	..
Huddersfield	„ 8	4,552	— 40	10	19,899	— 126	29·5	1
Hull	„ 8	5,891	+ 74	10	28,227	— 594	13·5	1
Ilkeston	„ 6	248	— 62	10	828	— 582	..	..
†Ipswich	May 25	439	+ 15	8	3,318	+ 122	10·5	..
Kilmarnock	June 1	816	— 9	2	431	— 14	4·25	..
Lancashire United	„ 5	3,227	+ 142	23	29,005	— 254	39	..
Leeds	„ 8	17,091	— 41	10	77,175	+ 1,748	113·7	..
Leicester	„ 8	5,751	— 59	..	..	..	20	..
Leith	„ 8	1,325	— 83	8⅔	2,333	— 50	3·72	..
Liverpool	„ 1	25,461	+1,387	21⅔	256,373	+12,488	116	..
‡L.C.C.	May 29	91,560	+1,447	..	373,117	+ 172	140·5	1·5
London United	June 8	16,480	—1,744	23	140,158	— 1,474	..	..
†Lowestoft	„ 8	153	— 103	26	5,556	— 227	3·5	..
Manchester	„ 8	36,261	+ 395	10	168,646	+ 6,952	105	..
Newcastle	„ 8	8,467	— 330	..	41,853	— 761	31·2	..
†Newport	„ 1	876	+ 123	9	6,041	— 523	7·35	..
Oldham	„ 9	4,077	— 90	11	22,601	+ 230	28	..
Pontypridd	„ 8	728	— 226	10	4,418	— 947	5·5	..
Portsmouth	„ 1	4,876	+ 484	9	19,228	+ 601	15·75	..
Preston	„ 5	1,844	— 61	10	8,101	+ 123	10	..
Rotherham	„ 5	1,561	+ 62	9⅔	6,500	— 14	12	..
Salford	„ 10	11 013	— 522	10	52,276	+ 1,249	41	..
Sheffield	„ 11	14,120	+ 185	..	70,487	+ 261	40	..
Southampton	„ 5	2,774	— 34	9	11,706	+ 650	11	..
Southend-on-Sea	„ 5	1,847	— 774	10	6,919	+ 960	7	..
South Shields	„ 1	1,386	+ 119	9	5,384	+ 85	10·25	..
Tyneside	„ 5	1,118	— 167	23	10,371	+ 846	11	..
Wallasey	„ 8	2,567	— 112	9⅔	10,983	— 474	8·72	..
Walthamstow	„ 8	1,341	— 192	10	7,960	— 16	9	..
West Ham	May 30	6,003	+ 433	8⅔	23,942	+ 777	16·45	1
Wolverhampton	June 5	2,515	— 80	10	9,748	+ 35	13·75	1
Cen. London Rly.	„ 8	8,797	—1,025	23	106,805	—12,585	6·22	..
City & S. Lon. Rly.	„ 9	5 984	— 189	23	72,678	— 4,586	7·26	..
Dublin-Lucan Rly.	„ 7	400	+ 11	23	2,969	+ 78	7	..
G.N. and City Rly.	„ 8	3,162	+ 301	23	37,760	+ 2,365	3·5	..
L'pool Overh'd Rly.	„ 9	3,486	+ 232	..	35,129	+ 2,280	6·6	..
Llandudno-Col. Bay	„ 7	1,001	+ 187	27⅔	5,126	+ 351	6·5	..
Lond. Elec. Ry. Co.	„ 8	27,450	+ 865	23	325,260	+ 4,490	21·25	..
Mersey Railway	„ 8	4 484	+ 198	23	47,886	+ 204	4·5	..
Metropolitan Rly.	„ 9	96,191	+ 262	25	881,687	— 9,715	25·75	..
Met. District Rly.	„ 8	26,857	+2,471	23	288,915	+18,170	25	..
Anglo-Argentine	„ 3	101,955	+2,791	..	1,133,558	+42,559	..	..
‡Auckland	April 5	17,472	+1,098	..	172,044	+13,495	23·2	..
Bombay (B.E.T.)	May 10	6,315	+ 289	19	57,740	+ 8,536	..	..
‡Brisbane	..	..	..	..	..	..	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	June 8	7,578	+ 154	..	..	+ 8,403	..	..
Cape Electric T. Ld.	..	..	..	..	..	..	..	..
‡Kalgoorlie, W.A.	May	2,270	..	5	15,305	..	20·5	..
‡Lisbon	..	..	..	..	..	..	..	..
Madras	May 31	1.788	+ 387	..	16 653	+ 1,931	13·5	·75
‡Montevideo	May	26 669	+10 352	7	212,080	+29,535	..	..
Perth (W.A.)	June 7	3,613	+ 462	..	48,290	+ 6,182	29	..

* Compared with the corresponding period of 1911. † One week only.
‡ Includes horse, steam and other receipts. § One month.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations June 11th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	10	5⅛	5⅛	9¼ — 10¼	..	5 4 9
Do. 4½ % Pref.	10	4½	4½	8¾ — 9¾	..	4 12 2
Do. Second 6 % Pref.	10	6	6	10½ — 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	100 —102	..	4 8 3
Brompton & Kensington, Ord.	5	10	10†	8¾ — 8¾	..	5 14 3
Do. 7 % Cum. Pref.	5	7	7	7⅞ — 8⅛	..	4 6 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	97 —100 xd	..	4 0 0
Charing Cross, West End & City	5	5	5	4½ — 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4¾	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	8¾ — 4⅜	..	5 2 10
Do. Do. % Deb.	100	4	4	95 — 98	..	4 1 8
Chelsea, Ord.	5	5	5	4⅜ — 4⅝	..	5 2 7
Do. 4½ % Deb.	Stock	4½	4½	99 —102	+1	4 8 3
City of London, Ord.	10	7	8	18 — 20	—2	4 0 0
Do. 6 % Cum. Pref.	10	6	6	15 — 17	—1	3 10 7
Do. 5 % Deb.	Stock	5	5	119 —123	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	101 —104	..	4 6 7
County of London, Ord.	10	5	6	10⅜ — 11⅛	..	5 7 0
Do. 6 % Pref.	10	6	6	11⅜ — 11⅝	..	5 1 1
Do. 4½ % Deb.	Stock	4½	4½	108 —110	..	4 1 10
Do. 4½ % Second Deb.	Stock	4½	4½	100 —103	..	4 8 3
Edmundson's, Ord.	5	Nil	Nil	⅛ — ¼	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3 — 3½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	86 — 89	..	5 1 2
Folkestone	5	6	6	4⅜ — 4⅞	..	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4⅝	..	5 5 3
Do. 4½ % First Deb.	100	4½	4½	93 — 96	..	4 18 9
Hove	5	9	9	6¾ — 7¼	..	6 4 2
Kensington & Knightsbridge, Ord	5	9	9	7¼ — 7¾	..	5 16 2
Do. 4 % Deb.	Stock	4	4	92 — 95	..	4 4 3
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	3	2	2½	1⅛ — 1⅜	..	4 5 6
Do. 6 % Pref.	5	6	6	4⅜ — 5⅛	..	5 14 3
Do. 4 % First Mort. Deb.	Stock	4	4	92 — 95	..	4 4 3
Metropolitan	5	5	4	3⅞ — 4⅛	..	6 1 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	101 —104	..	4 6 7
Do. 3½ % Mort. Deb.	Stock	3½	3½	85 — 88	..	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96 — 98	..	4 11 10
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4½ — 5	..	5 0 0
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	97 —100	..	5 0 0
Notting Hill, 6 % Non-Cum. Pref.	10	..	6	10¼ — 11¼	..	5 6 8
Oxford	5	7½	7½	5⅛ — 5⅜	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10	8 — 8⅜	..	5 14 3
Do. 7 % Pref.	5	7	7	6⅞ — 7⅛	..	4 15 0
Do. 3½ % Deb.	100	3½	3½	85 — 87	..	4 0 6
Smithfield Markets, Ord.	5	Nil	2	1⅜ — 1⅞	..	..
South London, Ord.	4	5	5	2⅜ — 3½	..	6 8 0
Do. 5 % First Mort. Deb.	100	5	5	99 —102	..	4 18 0
South Metropolitan, 7 % Pref.	1	7	7	1⅜ — 1⅝	..	6 1 0
Do. 4½ % First Deb. Stock	100	4½	4½	96 — 99	..	4 11 0
Urban, Ord.	5	5	..	⅛ — ¼	..	..
Do. 5 % Cum. Pref.	5	5	2	2⅛ — 3 xd	..	3 6 8
Do. 4½ % First Mort. Deb.	100	4½	4½	86 — 88	..	5 2 3
Westminster, Ord.	5	10	10	8½ — 8¾	..	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	5⅛ — 5⅜	..	4 4 8

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅜ — 5⅞	..	5 2 2
Calcutta, Ord.	5	8½	8½	7¼ — 7½	..	5 9 8
Do. 5 % Pref.	5	5	5	5 — 5½	..	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	6	97 — 99	+ ½	5 1 0
Canadian Gen. El. Com.	$100	7	7†	112 —116	..	6 0 8
Do. 7 % Pref.	$100	7	7	118 —122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	3	3†	1⅜ — 1⅝	..	3 4 0
Do. 5 % Deb.	100	5	..	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	95½ — 97½	..	6 3 1
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	83 — 86	..	5 16 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	94⅛ — 96½	— ½	5 3 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	⅞ — 1	..	Nil
Do. 6 % Pref.	1	6	6	7/8 — 8/8	..	8 6 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	105 —108	..	4 12 7
Madras, Ord.	5	..	..	2¼ — 2⅜	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	104 —107	..	4 13 6
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	90½ — 92½	..	5 8 1
Mexican Lt. & Power, Common	$100	4	4	91 — 93	..	4 6 0
Do. 7 % Cum. Pref.	$100	7	7	105 —107	..	6 10 10
Do. 6 % 1st Mort. Gold Bds.	..	5	5	96½ — 98½	+ ⅛	5 1 6
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	89½ — 90½	+ ½	5 10 6
Montreal, Lt., H. and Power	$100	7	8	211 — 215	..	3 14 5
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	39 — 42	..	11 18 2
River Plate, Ord.	Stock	10	10	240 —250	..	4 0 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	109 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	103 —105	..	4 15 3
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital	$100	4	5†	139 —143	—1	3 10 0
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	111½ —113½	..	4 8 1
Do. 4½ % Per. Deb.	Stock	4½	4½	103 —105	..	4 5 9
Toronto Power, 4½ % Deb.	Do.	4½	4½	100½ —102½	..	4 7 10
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92½ — 94½	..	5 5 10
Victoria Falls Power, Pref.	1	Nil	11¼d.	32/32 — 34/32	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	105½ —107½	..	5 11 7

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4†	7¼ — 7⅞	..	..
Do. 5 % Deb. Red.	Stock	5	5	97½ — 99½	..	5 0 6
American Telep. & Teleg., Cap.	$100	8	8†	148½ —150½	..	5 6 4
Do. Collat. Trust	$1000	4	4	95½ — 97½	..	4 2 1
Anglo-American Telegraph	Stock	8¾	8	65 — 67	..	4 9 7
Do. 6 % Pref.	Do.	6	6	109 —110	+ ½	5 9 1
Do. Def.	Do.	30/-	30/-	25½ — 26	..	5 15 5
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	7	..	7¾ — 8	..	4 10 4
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	82 — 85	— ½	4 14 2
Cuba Telegraph	10	6	6†	9¾ — 10⅛	..	5 14 3
Do. 10 % Pref.	10	10	10	16½ — 17½	..	5 14 3
Direct Spanish Telegraph, Ord.	5	4	4†	3¾ — 3⅞	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	7 — 7½	..	6 9 0
Direct United States Cable	10	4½	5	7⅛ — 8	..	6 5 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	..	4 9 1
Eastern Telegraph, Ord. Stock	Stock	7	5†	130—133 ex all	—1	5 5 3
Do. 3½ % Pref. Stock	Do.	3½	3½	78¾ — 80½ xd	+ ½	4 7 0
Do. 4 % Mort. Deb.	Do.	4	4	99⅛ —101¼	..	3 18 10
Eastern Extension	10	7	5†	12⅝ — 13¼	..	5 5 8
Do. 4 % Deb.	Stock	4	4	99 —101	..	3 19 3
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	97 —100	..	4 0 0
Globe Telegraph and Trust	10	5⅞	6†	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	13 — 13½	..	4 9 0
Great Northern Telegraph	10	18	18	29½ — 30½	..	5 18 10
Indo-European Telegraph	25	13	5†	56 — 58	..	5 12 1
Mackay Companies Common	$100	5	5†	83 — 85	..	5 17 8
Do. 4 % Cum. Pref.	$100	4	4	70 — 73	..	5 9 7
Marconi's Wireless Telegraph	1	5	20	5⅛ — 5⅜	— 1/16	3 8 10
Do. 7 % Cum. Partic. Pref.	1	16	17	4⅞ — 5⅛	— ⅛	3 6 5
Monte Video Telephone, Ord.	1	6	6	1 — 1⅛	..	5 6 3
Do. 5 % Pref.	1	5	5	¾ — ⅞	..	5 14 3
National Telephone, Pref.	Stock	6	6	100 —103	..	..
Do. Def.	Do.	6	6	149 —151	—2½	..
Do. 5 % Non-cum. 3rd Pref.	5	5	5	6⅛ — 6⅜	..	..
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	99 —100	..	4 10 0
Oriental Telep. and Elec.	1	8	8	1⅛ — 1⅜	..	4 18 0
Do. 6 % Cum. Pref.	1	6	6	1⅛ — 1⅜	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	89 — 91	..	4 8 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99½ —101½	..	3 18 10
Reuter's	8	5	5†	11 — 11½	..	3 9 7
Submarine Cables Trust	Cert.	6	6	127 —130	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7¼ — 7⅝	+ 1/16	5 0 10
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅜	..	4 8 11
West Coast of America	2½	2½	2½	1⅝ — 1⅞	..	4 0 0
Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4	4	95 — 98	+ ½	4 1 8
West India and Panama Teleg.	10	1½	½	2⅞ — 3⅛ xd	— 1/16	1 13 4
Do. 6 % Cum. 1st Pref.	10	6	6	10½ — 10⅝ xd	..	5 13 0
Do. 6 % Cum. 2nd Pref.	10	6	6	9⅞ — 10½ xd	+ ½	5 17 1
Do. 5 % Debs.	100	5	5	102½ —104½	..	4 15 8
Western Telegraph, Ltd.	10	7	6†	18⅛ — 18⅝	— ⅛	5 2 9
Do. 4 % Deb.	Stock	4	4	98 —100	..	4 0 0
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	100 —103	..	4 7 5

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations June 11th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	* 1	Nil	Nil	⅞ — 1 1/16	..	Nil
Do. 5 % Pref.	1	5	5	1 1/16 — 1 1/8	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	78 — 83	..	5 8 5
Brit. Elec. Trac., 6 % Pref.	100	..	..	10⅜ — 12½	..	..
Do. Do. Deferred	100	..	..	5½ — 7⅝	−1	..
Do. Do. 6 % Cum. Pr'f.	100	..	6	93 — 95	+1	6 6 4
Do. 7 % Non-Cum. Pr'f.	100	..	..	43 — 47	−1	..
Do. 5 % Perp. Deb.	100	5	5	98 — 97	..	5 3 1
Do. 4½ % 2nd Deb.	100	4½	4½	79 — 83	..	5 8 5
Central London Railway, Ord.	100	3	3	79 — 81	−1	3 14 1
Do. Pref.	100	4	4	84 — 86	..	4 13 0
Do. Def.	100	2	2	78 — 80	−2	2 10 9
Do. 4 % Deb.	100	4	4	101 —103	..	3 17 8
City & South London, Ord.	100	1½	1½	88 — 89	−1	4 3 4
Do. 5 % Pref., 1891	100	5	5	108 —110	..	4 11 0
Do. Do. 1896	100	5	5	104 —106	..	4 15 3
Do. Do. 1901	100	5	5	104 —106	..	4 14 4
Do. Do. 1908	100	5	5	103 —105	..	4 15 3
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
Dublin United Trams, 6 % Pref.	10	6	6	10⅝ — 11⅜	..	5 2 2
Great Northern & City, Pr'f. Ord	10	Nil	..	1⅛ — 1⅜	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	6	7/16 — 9/16	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	71 — 76	..	5 18 5
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2¼ — 2⅜	..	4 11 0
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Lancashire United, 5 % Deb.	100	5	5	83 — 85	..	5 17 8
London Elec. Railw'ys, 4 % Deb.	100	4	4	97 — 99	..	4 0 10
London United Trams, 5 % Pref.	10	Nil	..	5⅛ — 5⅜	..	..
Do. 4 % Deb.	100	4	4	77 — 80	..	5 0 0
Metropolitan Railway Consol.	* 100	1⅜	1⅞	64½ — 65	−1⅜	£ s. d. 2 17 9
Do. Surplus Lands	100	2⅜	2⅝	67 — 69	+1	4 3 4
Do. 3½ % Deb.	100	3½	3½	89 — 91	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	86 — 88	..	3 19 7
Do. 3½ % Con. Pref.	100	3½	3½	87 — 89	..	3 18 8
Metropolitan District Ord.	100	Nil	..	42½ — 43	−1½	Nil
Do. 6 % Deb.	100	6	6	144 —146	..	4 2 3
Do. 4 % Deb.	100	4	4	96 — 98	..	4 1 8
Do. 4 % Prior Lien	100	4	4	99 —101	..	3 19 3
Do. 4½ % First Pref.	100	3½	4½	90 — 92	..	4 17 10
Do. 3½ % Gtd.	100	2⅝	3½	76 — 78	..	4 9 3
Metropolitan Elec. Trams, Ord.	1	5½	6	3/16 — 1	..	6 0 0
Do. Def.	1	Nil	..	1/16 — 3/16	..	Nil
Do. 5 % Pref.	1	5	5	3/16 — 5/16	..	5 10 6
Do. 4½ % Deb.	100	4½	4½	100 —101	..	4 10 0
Do. 5 % Deb.	100	5	5	3 —100	..	5 0 0
Potteries, Ord.	1	2	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	..	1/2 — 9/16	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
South Metro. Trams, 6 % Pref.	1	6	..	1/16 — 1/8	..	7 7 8
Do. 4 % Deb.	100	4	4	72 — 77	..	5 4 0
Underground Elec. Railways	10	..	..	8⅞ — 9⅛	— ⅛	Nil
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1	1⅛	89 — 90	−2	..
Yorkshire (West Riding), Ord.	5	Nil	..	2 1/16 — 2 3/16	..	Nil
Do. 6 % Pref.	5	5 1	..	3⅛ — 3½	..	Nil
Do. 4½ % Deb.	100	4½	4½	80 — 84	..	5 7 2

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	£5	5	5½	5 5/16 — 5 7/16	..	4 18 10
Do. 2nd Pref.	£5	5	5⅝	5 7/16 — 5 9/16	+ 1/16	5 8 6
Do. 4 % Deb.	100	4	4	96⅛ — 98	+1	4 1 8
Do. 4½ % Deb.	100	4½	4½	101½ —103½	..	4 7 0
Do. 5 % Deb.	100	5	5	101 —103 xd	−1	4 17 1
Auckland Trams, 5 % Deb.	100	5	5	104 —106	..	4 14 4
Bombay Elec. S. & Trams, Pref.	10	6	6	11⅛ — 11⅝	..	5 3 3
Do. 4½ % Deb.	100	4½	4½	98 —100	..	4 10 0
Do. 5 % 2nd Deb.	100	5	5	99 —101	..	4 19 0
Brisbane Trams Invt., Ord.	£5	8	8	6⅜ — 7⅛	— ⅛	..
Do. 5 % Pref.	£5	5	5	4⅞ — 5⅛ xd	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5
B. Columbia Elec. Rly., Def.	100	8	8½	140 —144	..	5 11 1
Do. Pref. Ord.	100	6	6	124 —127	−2	4 14 6
Do. 5 % Pref.	100	5	5	111 —114	..	4 7 9
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98½—101½	..	4 8 8
Do. 4½ % Vancouver Deb.	100	4½	4½	103 —105	..	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	104 —106	..	4 5 0
Calcutta Trams, Ord.	£5	6	7	6⅛ — 6⅝	..	5 5 8
Do. 5 % Pref.	£5	5	5	4 13/16 — 5 1/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5
Cape Electric Trams	1	Nil	2½†	1/8 — 3/16	..	..
City Buenos Aires Trams (1904)	£5	5	5	5 1/16 — 5 3/16	..	4 10 6
Do. 4 % Deb.	100	5	5	101— 103	..	4 17 3
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	94 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	101 —104	..	4 16 2
Kalgoorlie Elec. Trams	1	Nil	..	1/16 — 3/16	..	Nil
Do. 5 % A Deb.	100	5	5	91 — 94	..	5 6 5
Do. 6 % B Deb.	100	5	6†	56 — 60	..	10 0 0
La Plata Elec. Trms, Ord.	1	..	..	1/16 — 3/16	..	..
Do. Pref.	1	6	6	7/8 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	5½	6	1 — 1⅛	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	95 — 99	..	5 1 0
Madras Elec. Tr. (1904), Deb.	100	5	5	101 —103	+1	4 17 1
Manaos Trams & Lt., 1st Deb.	100	5	5	92 — 95	−1	5 5 8
Manila Elec. R. and Ltg., Bonds	$1000	5	5	102½—104½	..	4 15 8
Mexico Trams Com.	$100	7	7	122 —124	−1	5 13 0
Do. Gen. Con. 5 % Bonds	..	5	5	98½—100½	..	4 19 6
Do. 6 % Bonds	100	6	6	103½—105½	..	5 13 9
Para Elec. Rlys. & Lt., Ord.	£5	10	10	7 — 7⅜	..	6 15 7
Do. 6 % Pref.	£5	6	6	5 — 5½	..	7 0 4
Do. 5 % 1st Deb.	100	5	5	100 —102	..	4 18 0
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1 1/16 — 1 1/8	..	1 18 4
Do. 5 % 1st. Deb.	100	5	5	101 —104	..	4 16 2
Rangoon El. Tr. & Sup., Pref.	£5	6	6	5⅜ — 5⅝	..	5 6 8
Do. 4½ % 1st Deb.	100	4½	4½	99 —101	..	4 9 1
Rio de Janeiro Trams	$100	4½	5†	141 —143	+ ½	3 10 0
Do. 1st Mort. 5 % Bonds	..	5	5	105½—107½	— ½	4 13 0
Do. 5 % Mort. Bonds	100	5	5	99 —100	..	5 0 0
Sao Paulo Tram, Lt. and P.	$100	10	10†	248 —253	−2	3 19 0
Do. 5 % 1st Deb.	$500	5	5	105½—107½	— ½	4 13 0
Singapore Trams, 5 % Deb.	100	5	5	79 — 82	..	5 19 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	+1	5 2 0
Un. Elec. Trams Monte Video	£5	6	7	5½ — 6	..	6 1 11
Do. 6 % Pref.	£5	6	6	5 — 5½	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	100 —103	..	4 17 1
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	104½—106½	..	4 4 6

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	1⅛ — 1 3/16	..	7 7 8
Do. 6 % Pref.	1	9	6	9/16 — 11/16	..	7 2 2
Babcock & Wilcox	1	26	28	3 5/16 — 3 7/16 xd	..	..
Do. Pref.	1	6	6	1⅜ — 1⅝	..	3 18 10
B.I. & Helsby Cables	£5	10	10	7 — 7⅛	..	6 13 4
Do. Pref.	£5	6	6	6 — 6½	..	4 12 4
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	95 — 97	+3	4 12 9
British Westinghouse, Pref.	£3	Nil	..	1/16 — 1/8	— 1/16	Nil
Do. Deb.	100	4	4	61 — 64	−2	6 5 0
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	Nil	..	1/6—2/-	..	Nil
Do. Pref.	1	Nil	..	5/- —6/-	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ½	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	77½ — 82½	..	6 1 3
Do. 4½ % Deb.	100	4½	4½	54 — 59	..	7 10 6
Do. 4½ % Second Deb.	100	4½	4½	37 — 42	..	10 14 4
Callender's Cable	£5	15	10†	10⅝ — 11⅛	..	6 10 5
Do. Pref.	£5	5	5	5 — 5½	..	4 15 8
Do. Deb.	100	4½	4½	100 —102	+ ½	4 8 3
Castner-Kellner	1	17½	20	35 — 38 xd	..	5 10 2
Do. Deb.	100	4½	4½	105 —109	..	4 10 7
Crompton & Co.	£3	Nil	Nil	½ — ¾	..	Nil
Do. Deb.	100	5	5	56 — 66	..	7 7 1
Dick, Kerr	1	5	..	27/32 — 29/32	..	5 8 1
Do. Pref.	1	6	6	1 1/16 — 1 1/8	..	5 12 11
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Edison & Swan, A, £3 paid	£5	Nil	..	3/8 — 7/16	..	Nil
Do. fully paid	£5	Nil	..	1/2 — 2/3	..	Nil
Do. 4 % Deb.	100	4	4	68 — 72	..	5 11 1
Do. 5 % Second Deb.	100	5	5	75 — 78	..	6 8 2
Electric Construction	£2	Nil	2½†	3/4 — 1	..	..
Do. Pref.	£2	7	7	1 1/2 — 2	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	7½ — 8½	..	8 5 8
Do. Deb.	100	5	5	94 — 96	..	5 4 2
General Electric, Pref.	10	5	5	9 — 9½	..	5 5 3
Do. Deb.	100	4	4	85 — 90	..	4 8 11
Henley's, Ord.	£5	15	10†	11⅜ — 12½	..	6 0 0
Do. Pref.	£5	4½	4½	4 13/16 — 5 1/16	..	4 6 9
Do. Deb.	100	4½	4½	101 —103 xd	..	4 7 5
India-Rubber, G. & T.	10	10	..	8½ — 9½	..	..
Do. Pref.	10	5	5	9½ — 10½	..	4 17 7
Telegraph Construction	£2	20	10†	38 — 35	..	6 19 5
Do. Deb.	100	4	4	90½—101½	..	4 9 0
Willans & Robinson	1	Nil	..	1/16 — 1/8	..	Nil
Do. Pref.	£5	Nil	..	1/2 — 1	..	Nil
Do. Deb.	100	4	4	58 — 60 xd	..	6 13 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

WAGES SYSTEMS.

By J. WALTON and A. E. BREWERTON, A.M.I.E.E.

It is not often that workshop wages systems find any place in the electrical Press, yet it is surprising they do not do so in view of the keen competition which exists in the manufacture of electrical goods at the present time, and of the increasing influx of foreign apparatus; no doubt this state of affairs is felt by makers of small, rather than large, work, but competition is universal, and whilst its effect is good to the extent to which it stimulates a necessity to reduce selling prices, there certainly exists a bad influence tending to sacrifice efficiency, unless the manufacturing costs can be reduced by scientific handling.

Roughly, manufacturing costs are made up of the cost of labour and material, plus the factory and dead charges. To reverse the order of things, factory and dead, or administration, charges cannot be drastically diminished, and although in an existing factory it may be possible to reduce waste or supervision items, such savings are often made at considerable expense in other directions; so that, unless a works has been badly managed in the past, the analogy of "swings and roundabouts" is applicable.

The cost of material must obviously be minimised, but the methods of so doing are beyond our province.

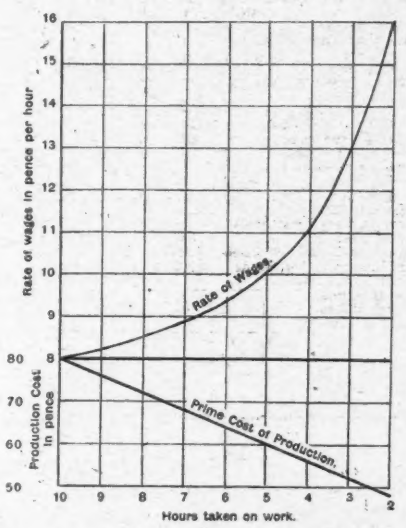
It is, therefore, necessary to consider how the labour item can be reduced. Of course, this is controlled largely by the quantities manufactured, the tools and gauges employed and the rate paid for labour; all of which are distinct from any method of reducing the cost of unit production under existing circumstances by the adoption of some sort of piecework or premium system of wages. There are numerous systems of these kinds in vogue, and it will be of interest to cite a few points in connection with them before passing to a system which bears some elements of originality and has distinct advantages.

The ordinary hourly rate system requires no explanation, and is, of course, the most simple method by which labour can be paid for, but unfortunately it gives no incentive for a man to work at a greater rate than he is compelled. There are certain sections who fight for the maintenance of this system, and against all innovations, upon the ground that no man should be made to do more than a good day's work such as he would do upon an hourly rating, and also the contention is put forward that if the cost of labour is reduced unemployment will be increased, and so on. These arguments are, however, too hackneyed to be answered here. The fact remains that a departure from the hourly rate system invariably leads to increased efficiency. Undoubtedly the crux of the problem lies in creating an incentive and recognising that where skilled labour is employed, each man is or should be an expert in his own particular sphere. The latter fact has been made use of in the "Suggestion Scheme" whereby all suggestions which lead to improvements in designs or productions are paid for by the employer; for various reasons this practice is becoming less popular, possibly because it allows individual workpeople to be in touch with the management above the heads of their foremen.

It has been proposed that bonuses should be distributed in a works according to a firm's yearly profits; this may be feasible in a very small concern, but there are obviously weak points, inasmuch as the firm's profits are affected by numerous factors which are quite beyond the control of workpeople, either individually or collectively. Moreover, very few workers are inclined to exert themselves in January for a possible reward in December.

The piecework arrangement has gained almost universal popularity, as it is infinitely better to make payments upon the actual work done than according to the time at which people come and go, but careful handling is absolutely necessary to obtain efficiency without friction. Whether a rate-fixer be employed, or whether the prices are fixed by the works manager and foremen, depends upon the class of work and size of factory, but the rates must be fairly correct. Theoretically, piecework prices should be very seldom altered, otherwise the cutting of prices produces ill-feeling and lack of faith upon the part of the workers towards the management. Often these points are not considered, particularly in larger firms, but there is little doubt that continuity of service and amicable working are valuable acquisitions. In practice, piecework prices have to be reduced from time to time, and hence "nursing" is bound to be prevalent. "Nursing" possibly is a technicality requiring explanation: if it becomes a practice to reduce prices frequently and to judge the value of work upon the increase which a man makes upon his hourly rate, he very quickly realises that, as soon as he exceeds a certain proportion over his rate, the price is to be cut, and his course is obvious; again, there is little reward for any suggestion he may make, if, in consequence, a reduction is made. To take the opposite, and perhaps impossible, view, where a price is fixed once for all, then the workman does his utmost to increase the output, but the result is hardly fair, since the whole of the profits are his, the only profit to the employer being the indirect advantages of producing work quickly and the consequent reduction in factory charges. Besides being unfair from the employer's point of view it may re-act upon the man, inasmuch as the cost of production is fairly uniform, and the necessity of keeping a man well supplied with material is not paramount, since it makes but little difference if the man remains idle for a few minutes in every hour or so. In the same way it does not greatly add to efficiency to keep machines tuned up and to facilitate rapid production except for the reasons stated. What is wanted, therefore, is not only an incentive, but some system worked upon a profit-sharing basis.

The premium system fills the latter requirement, and cannot, therefore, be passed over; according to this plan each job is given a certain time, and a bonus is given in accordance with the number of hours saved, the amount of which is often based upon half the hourly rate for every hour saved. For example: if a man whose rate is 8d. per hour is given a job to do in 10 hours and does it in five hours, then he receives five hours at 8d. = 3s. 4d., plus five hours



Curve 1.

at 4d. = 1s. 8d., total 5s., or in other words, the rate in this case rises from 8d. to 1s. per hour. It will be noticed, however, by referring to Curve 1, that the rate of wages increases out of proportion to the saving in cost of production.

The system which the writers have recently evolved shows a much fairer state of things, as will be seen from Curve 2, since the hourly rate increases at exactly the same rate as the decrease in cost of production; the profit upon the time saved is, therefore, equally divided. The method of working this system is to divide the money earned upon the hourly rate by the time allowed and multiply by the time saved, thus:—

$$\text{Bonus} = \text{amount earned upon hourly rate} \times \frac{\text{time saved}}{\text{time allowed.}}$$

It will at once be noticed that it is impossible for any man to earn double his rate, which is a good point when it is considered that no man should be paid at double the rate

at which he is ordinarily valued, and secondly, it is not necessary to exercise much care in the estimating of jobs.

So far only the actual cost of labour has been considered, but, of course, to this have to be added the factory charges, so that, assuming that they are 100 per cent., the final cost will be represented by Curve B. This, however, is only partly correct, as some items, such as establishment charges,

Having gone so far, it may be of service to deal briefly with the practical side of this system, which so far has only been viewed theoretically. Of course, every job when given out must have its shop order in the usual way, and also a "time allowed," so that both can appear upon a time card made out by the workman and signed by his foreman and a timekeeper. This card will then appear as follows :—

Check No. 146. *Name* J. Jones. *Date* April 29th, 1912.

Ticket No.	ARTICLE.	Shop Order No.	DAY WORK. Operation.	Quantity.	Time Allowed	Time Taken.	Time Allowed.	Time Saved.	Day Rate.	For Office use only. Wages.	Bonus.	Total.
24	Bushes	192	Turning	200	$\frac{100}{1}$*	1½	2	½	6	0 9	0 2½	0 11½
39	Bushes	192	Screwing	200	$\frac{50}{1}$	2½	4	1½	6	1 3	0 9	2 0
21	Bushes	192	Finishing	200	$\frac{25}{1}$	$\frac{6}{10}$	8	2	6	3 0	0 9	3 9
												6 8½

Entered by	*J. R.*	Viewed by	*E. F.*	*E. F.*	*E. F.*	*E. F.*	
Quantity Passed	*E. F.*	Passed	200	200	200		6s. 8½d. †
Operation Passed	*H. R. R.*	Rejects	—	—	—		
Time Passed	*F. B.*	Waste	—	—	—		

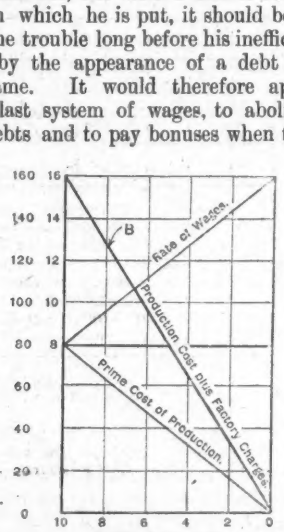
* $\frac{100}{1}$ = 100 per hour.

† Payment would, of course, be to the nearest penny or halfpenny.

are proportional to the time, whilst the depreciation of tools increases with the rate of production.

In an ordinary piece-work system, when a man loses upon a job at a price which he has accepted, it is quite usual and legal to pay only what is actually earned; but with the scheme suggested such a policy is not so easy, since the actual price of the job is not given, and it may, therefore, be held that it is not a definite contract. This point is perhaps arbitrary, but there lies an option in some form of debt system where the debts are paid by the balancing of fat jobs against the lean ones, or wiped out periodically. To carry this scheme to the extent which is done by some firms, and to let debts accumulate over a long period, can hardly be considered good when the hopelessness of becoming solvent is sufficient to discourage a man and rob him of all enthusiasm.

It is unfortunate that men who do not fit their jobs have to be weeded out, but when a man is not satisfactory in the position in which he is put, it should be the foreman's duty to locate the trouble long before his inefficiency has made itself obvious by the appearance of a debt of £20 to £30 against his name. It would therefore appear best, in adopting this last system of wages, to abolish all idea of running up debts and to pay bonuses when they are earned



Curve 2.

and the ordinary hourly rate when the time limit is not worked up to; this may appear entirely one-sided, since the workman always stands to gain and can lose nothing, but it must be recognised that one always expects to earn slightly more upon piece-work, and very rightly so; but when the employer saves 2d. for every 1d. bonus earned by the workman (Curve B), it is obvious that the advantages of bonuses are mutual. There lies, however, a deeper and more vital point in this abolition of debt systems, inasmuch as there is bound to be friction as soon as a new system of wages is adopted, but if it can be said (and proved) that a workman cannot lose, then everything is plain sailing.

It may appear that a ponderous number of figures have to be dealt with to arrive at the amount to be paid, especially when such figures as $2/1\frac{1}{4} \times \frac{3\frac{1}{4}}{5\frac{3}{4}}$ are come across; to work out two or three hundred time cards on paper is certainly laborious, but when one man writes down the figures and another makes the necessary calculations upon a slide rule there is no difficulty in disposing of 200 items an hour; and were it ten times as long, the advantages of a system could not be discounted on account of a slight amount of extra clerical work.

ELECTRICAL PROGRESS IN NEW ZEALAND.

[FROM A SPECIAL CORRESPONDENT.]

In a somewhat quiet unobtrusive way, electrical development in the Dominion is steadily advancing, and although the market from the English manufacturer's point of view is still small, it is nevertheless a growing one. Its industries are, and are likely to remain, dependent on the pastoral and agricultural community for some time, but a number of good seasons for many years in succession have led to a general feeling of buoyancy in which the towns have naturally shared, and with their expansion and increasing trade have come numerous tramway, lighting, and other schemes of public utility.

Not only is this the case in the four main cities, but most of the smaller towns and townships have some such work either in hand or in contemplation. Of the new works actually in progress, perhaps the most important are the additions to the municipal stations at Auckland and Dunedin. The former city has grown altogether beyond the capacity of the lighting plant which has been run in connection with the refuse destructor, and the Council has, therefore, launched out into a wider scheme, commencing with some 3,000 kw. of new plant. This is entirely distinct from the tramway service, which is run by a private company. Then, Dunedin is supplementing its high-tension supply from the hydro-electric station at Waipori Falls with over 800 kw. of new plant driven by Diesel engines. The town of Invercargill has just inaugurated its tramway service with street lighting along the route. This plant has the distinction of being probably the most southerly installation in the world.

Napier has just placed contracts totalling about £50,000 for a complete service of tramways, public and private lighting, but the expenditure required having somewhat exceeded the engineer's estimates, owing to the rise in cost of material

since they were presented, the project is subject to the ratepayers sanctioning the further loan now required.

The towns of Gisborne and Hastings are installing plant, in each case driven by Diesel engines, and both are proposing to deal with their sewage by means of electrically-driven pumps. Gisborne has purchased two Edison storage battery cars, and if they prove successful, their number will be added to. Of private works may be mentioned the scheme for supplying the Waihi gold mines with power transmitted at high pressure from a hydro-electric station, and the equipment of the Union Steamship Co.'s new works at Evan's Bay, Wellington. Of new work coming forward, by far the most important is the initial scheme of the new hydro-electric department of the public works, which involves the supply of power through the fertile Canterbury Plains from Lake Coleridge to Christchurch and Timaru. The contract for the tunnel through which the water will flow, from the lake to a point near the power house, has already been let, and specifications are also issued for the main items of machinery, &c. The ultimate capacity of the station is 9,000 KW., of which half is to be installed at first in three units of 1,500 KW. each. The transmission lines to Christchurch will be worked at a pressure of 66,000 volts, and the distance is 70 miles. The scheme, in addition to supplying power in bulk to the city of Christchurch, also includes the electrification of the railway to its port, Lyttleton, a distance of seven miles, of which two miles is tunnel. Christchurch being one of the principal industrial centres, it is anticipated that, when the new supply is available, there will be a considerable demand for power at the various works.

Timaru has already secured expert opinion as to a tramway and lighting scheme, and the growth of the borough, as well as its port expansion, makes a cheap supply of electric power altogether desirable.

The Government also anticipates a considerable aggregate demand from the farming community and others adjacent to the transmission lines, not only for lighting, but also for the driving of farm machinery; but the individual demand from this source will necessarily be small.

Whilst the Government now retains the rights to water-power development throughout the Dominion, it is not expected that it will actively commence any further schemes until the Lake Coleridge transmission is actually at work, although prospecting and surveying have already been carried out elsewhere. For instance, the experts of the various bodies interested have already conferred, with a view to supplying the city of Wellington with power from the Hutt River, involving transmission of about 20 miles. This line would incidentally be available for the Government railway workshops at Petone, for two of the largest freezing works in the Dominion, and for a woollen mill *en route*, as well as for one or two local bodies.

In the same neighbourhood is one of the steepest gradients of the State railways, and the department is studying the problem of the working of main lines in Europe and in America, in view of the possible saving in running cost, as well as time, by the substitution of electric for steam traction.

Again, New Plymouth has decided to go ahead with its tramway scheme, and has called in a consultant to advise as to the route. Palmerston North is placing before the ratepayers a project for the installation of a tramway service involving an expenditure of about £60,000. The borough of Miramar, which is now served by the lighting and tramways systems of Wellington, has adopted a scheme for an independent plant driven by Diesel engines, and the town of Feilding is contemplating a lighting scheme in the near future.

Apart from these public service schemes, the State Mines Department has called for tenders for a power and lighting plant for the collieries at Greymouth, on the West Coast, and there are to be installed at the outset continuous-current dynamos, steam-driven, aggregating 270 KW., variable speed motors for driving ventilating fans totalling 187 H.P., and two further motors of 80 and 45 H.P. respectively.

Although the list is still unexhausted, probably sufficient has been said to show that New Zealand is alive to the benefits which electrical supply gives. Should success attend the development of its oil resources, a further fillip may be expected with the advent of crude oil for fuel, and the popularity of the Diesel engine may be still further increased.

It may be noted incidentally that the oil field, which up to the present has shown the best results, is in the Taranaki district where there are unlimited supplies of ironsand, requiring no mining, awaiting a simple process of smelting and a supply of cheap power for the purpose.

It is proposed in a subsequent article to deal with the usual methods of calling for tenders, and the formalities to be observed by manufacturers in submitting offers. Since the Dominion does seven-eighths of its trade with the British Isles, the market may be regarded as an increasingly important one.

PROCEEDINGS OF INSTITUTIONS.

Condensers in Series with Metal-Filament Lamps.

By A. W. ASHTON, A.M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *May 16th*, 1912.)

THE object of this paper is to describe certain developments which have recently taken place in connection with the running of low-voltage metal-filament lamps in series with condensers on alternating current circuits.

In adopting condensers the improvement in the power factor of the whole circuit, although merely incidental, should not be lost sight of; a consumer taking a leading current should not be debited with the same proportion of capital cost as an ordinary lighting consumer. In the case of small houses the cost of wiring and of lamp renewals becomes of increasing importance, and it is in this direction that the use of condensers appears especially advantageous.

The condensers which have been employed in connection with metal-filament lamps have been of the Mansbridge type, consisting of tinfoil paper impregnated with paraffin, the impregnation being carried out by a new process, which is the invention of Mr. E. A. Bayles, of the British Insulated and Helsby Cables, Ltd. Prior to the introduction of the improved impregnating process it was the practice to carry out the paraffin-wax impregnation under vacuum. The condensers manufactured by this process have been found thoroughly satisfactory for telephone circuits, and certain other purposes for which they have been largely used.

In testing a large number of such condensers with alternating pressure it was found that breakdowns always occurred along a certain curve, viz, that connecting points of equal temperature in the wax while cooling after impregnation. This pointed to the possibility of the dielectric becoming weakened electrically due to shrinkage in cooling, and to the fact that the interstices between the layers of paper and tinfoil were not completely filled with paraffin. This drawback is obviated by the new process, the interstices being completely filled with paraffin, which results in the dielectric strength of a condenser of given thickness of paper being practically doubled.

The new process consists essentially in the immersion of the condenser roll in melted paraffin wax after vacuum impregnation, and the subjection of the wax to high mechanical pressure during the process of cooling. This pressure is about 1 or 2 tons per sq. in., and it is important to note that while the pressure is maintained on the paraffin, the condenser itself is not pressed upon in such a manner as will flatten or otherwise distort its shape. The pressure is maintained until the paraffin is cooled and set.

The superiority of the condensers produced by this process compared with the paraffin condensers hitherto produced is most marked, particularly with regard to dielectric strength and reliability when working on A.C. circuits; the recent developments in the use of condensers have been largely due to the introduction of this process.

A series of tests for the determination of the dielectric losses in condensers manufactured by the new process have been made by the author in the electrical engineering laboratories at Battersea Polytechnic.

The curves given in figs. 1 and 2 show the results obtained for a 15-microfarad condenser suitable for pressures up to 250 volts. In each case the losses are expressed in watts per microfarad, and also as percentage power factor. In obtaining the results shown in fig. 1, the voltage on the condenser was kept constant at 200, and the frequency was varied from about 40 to 100 cycles. The loss is very nearly proportional to the frequency within these limits, the power factor only increasing 25 per cent. when the frequency increases from 40 to 100 cycles per second.

In fig. 2 the results of tests on the same condenser at different voltages from 80 to 240, and a constant frequency of 50 cycles, are given. The loss increases with the voltage, and the power factor is considerably lower at the higher voltages, being as low as 0·38 per cent. at 240 volts, and increasing to 1·3 at 80 volts.

At 200 volts 50 cycles the power factor is 0·44 per cent., corresponding to a total loss of 0·85 watt for the 15-microfarad condenser. The overall dimensions of this condenser are 5¼ in. × 5¼ in. × 4¾ in., giving a total external surface of 160 sq. in., from which it is obvious that the temperature rise is absolutely

negligible. When this condenser is fully loaded, the lamps will aggregate from 80 to 90 watts, so that the efficiency is about 99 per cent. at full load. If this condenser is left continuously on a supply circuit it absorbs energy at the rate of about seven units per annum. Thus from every point of view the condenser is a highly efficient piece of apparatus, and owing to its small losses and negligible temperature rise it is practically impossible for it to deteriorate in use.

For incandescent lighting the condenser possesses certain valuable features, which, combined with its moderate cost, make it suitable for use in conjunction with low-voltage lamps where otherwise either high-voltage lamps would be used or an auto-transformer installed.

Apart from the higher efficiency and longer life of the low-voltage lamp, the latter is considerably cheaper to manufacture, and has a more robust filament. Further, when one considers the fact that the initial cost of a condenser for a single lamp is often not more than twice the cost of the lamp, it is evident that the prevention of one or two accidental breakages will easily cover the cost of the condenser.

The parallel system of connections necessitates the use of a condenser corresponding to each switch, as owing to the "constant-current" property of the condenser the number of lamps connected in parallel must be constant.

The size of the condenser must be determined with reference to both voltage and current of lamp, as well as the supply voltage and frequency. The capacity required is given by:—

$$K = \frac{C \times 10^6}{2\pi f \sqrt{v_1^2 - v_2^2}},$$

where K = capacity in microfarads, C = rated current of lamp, f = supply frequency, v_1 = supply voltage, v_2 = lamp voltage.

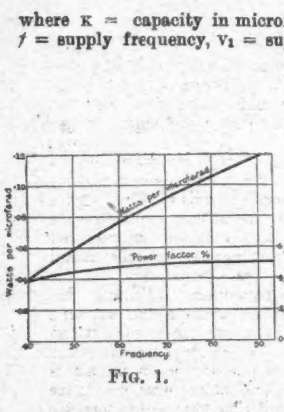


FIG. 1.

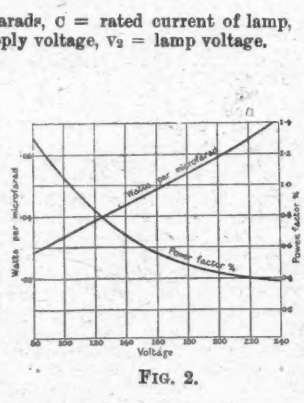


FIG. 2.

The capacity required is, therefore, directly proportional to the lamp current, and inversely proportional to the frequency and to the vectorial difference between supply and lamp voltages. Generally speaking, the application of condensers is limited to supply voltages of 200 or more at 50 cycles, except for comparatively low candle-power lamps (up to 10 watts). At frequencies of 70 to 100, however, the cost of condensers for running 50-volt lamps on 110-volt circuits comes out reasonably low even in the case of 28-watt lamps.

The capacities required for different lamp voltages are shown in figs. 3 and 4, from which some idea of the size of the condenser for any given lamp can be obtained. The capacity is inversely proportional to the supply voltage in the neighbourhood of 220 volts, *i.e.*, from 200 to 250.

From fig. 4 it can be seen that when using the parallel system for lamp voltages of less than 25, the cost of the condensers becomes rather excessive: but it must be noted that three 25-volt lamps may be run on the same condenser without appreciably increasing the capacity, and by adopting the series system these need not be all in one room, but can be separately controlled by short-circuiting switches.

The cost of the condensers may be represented approximately by the equation:—

$$\text{Cost in shillings} = a + b\,K,$$

where $a = 2{\cdot}0$ and $b = 1{\cdot}5$ for 250-volt condensers of capacity K microfarads.

Owing to the small dimensions, viz., 2½ in. × 2½ in. × 6 in. for the five-microfarad condenser, and the fact that the condensers work continuously with no appreciable temperature rise, they may be fixed in any out-of-the-way place.

The adoption of this system implies practically no disturbance of the existing wiring, but it becomes rather expensive in first cost where the aggregate of voltages of lamps in series with one condenser is low. The minimum capacity is required when the voltage on the lamp or lamps is 70·7 per cent. of the supply voltage.

On 200-volt circuits any lamp of a lower voltage than 60 can be replaced by a lamp of different candle-power provided the two lamps have the same rated current. Thus the same condenser is always suitable for a 5-watt 25-volt lamp and a 10-watt 50-volt lamp; and if the candle-power requires to be still further increased a 17 or 18-watt 100-volt lamp should be used.

The condensers are listed for running 25, 50, or 100-volt lamps on circuits of any pressure or frequency met with in practice, and it has been found convenient to refer to them by using serial numbers instead of the actual capacities.

This system is particularly applicable to the case of houses of moderate size, viz., of less than about 25 lights, in which the number of points where less than 25 watts is required will be about one-third of the total. In these cases condensers would be required

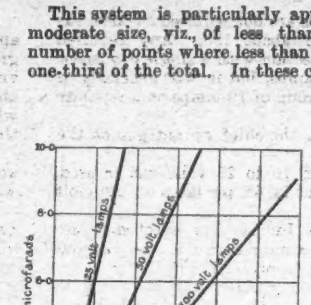


FIG. 3.

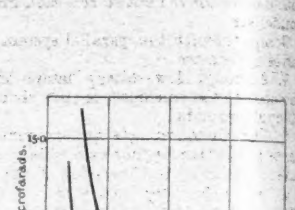


FIG. 4

only on the lower candle-power points, and in those positions where the lamps are liable to be handled.

The first cost is less than when an auto-transformer is installed, all "no-load" losses are obviated and the running losses are considerably reduced. Compared with the use of high-voltage lamps at all points, there is considerable saving in the cost both of energy and of lamp renewals, amounting in a number of cases to more than 50 per cent. on the assumption of equal life for the high-voltage and low-voltage lamps. It appears very probable that the actual saving will be greater.

The possibility of running a variable number of low-voltage lamps, all having the same rated current, in series with a single condenser and controlled by "short-circuiting" switches, is due to the fact that the vectorial difference between the two quantities in quadrature, when one is much smaller than the other, is very slightly less than the greater of the two quantities. Thus the condenser splits the supply voltage into two components in quadrature, and when the lamp voltage is as much as 30 per cent. of the supply voltage the condenser voltage is only 4·6 per cent. less than the supply voltage. With tungsten-filament lamps in series with the condenser the actual reduction in current is less than this, due to the decreased resistance of the filament when the current is below normal. The maximum percentage variation can be still further decreased by adjusting the capacity of the condenser to such a value that the lamps get their correct voltage when the aggregate of voltages of the "switched-in" lamps is 25 per cent. of the supply voltage. Under these conditions it is possible to use a variable number of lamps up to 35 or 40 per cent. of the supply

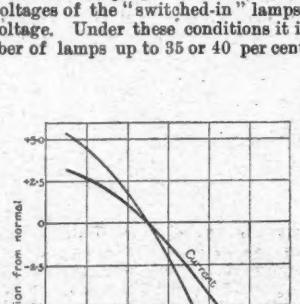


FIG. 5.

voltage without the lamp current deviating more than 3 per cent. from the normal.

In fig. 5 is given the percentage deviation of lamp current and voltage from the normal for different nominal lamp voltages, the rated current being correct when the lamp voltage is 25 per cent. of the supply voltage. Under these conditions the variation in the candle-power of the lamps is no greater than is given by carbon-filament lamps due to ordinary variations in voltage, but in any case the current variation may be made less than 3 per cent. if necessary by keeping below 35 per cent. of the supply voltage, *i.e.*, by adopting lower voltage lamps.

The necessary condition to be followed by the lamps in series with any one condenser is that they should all have the same rated current, the voltage being therefore proportional to the wattage required. Thus for a condenser giving 1 ampere, a 25-watt lamp must be rated at 25 volts, a 10-watt lamp at 10 volts, &c. With such a condenser the maximum wattage of lamps simultaneously in use on a 220-volt circuit would be about 80, but where, as

would generally be the case, all lamps are not required at once, the wattage of lamps installed may be about 120. Any required wattage of lamps can be used in connection with a single condenser by varying the rated current of the lamps, but it will generally be found more convenient to run each group of 10 lamps on a separate condenser.

Compared with the parallel system, the chief advantages of the series system are:—

1. Although low-voltage lamps of 10 to 25 volts can be used, the cost of the condenser is only about 2s. 6d. per lamp on 220-volt 50-cycle circuits.

2. The condenser acts as a current limiter and effectually prevents the consumer increasing his maximum demand to any serious extent without the knowledge of the supply authority.

3. By using switch-holders a considerable reduction can be effected in the cost of wiring due to there being only one wire run from ceiling rose to ceiling rose.

4. The electric stress on the insulation of the wiring is considerably reduced, and risk of fire due to "short-circuits" occurring is entirely eliminated, due to the fact that the power supplied by the circuit to the fault is limited by the condenser.

The series system is more particularly applicable to small houses or flats not requiring more than about 10 lights, and to groups of low candle-power points in larger houses. In the latter case the lamps may be all in one room and divided for convenience in illumination, or the whole of the smaller rooms in a house may be wired in series.

The current taken by the condenser is a maximum when all the lamps are short-circuited, and in the series system this will be about 3 per cent. greater than the normal current.

A further result of the current-limiting effect of the condenser is the prevention of the excessive rush of current which takes place when metal-filament lamps are switched on.

The extensive use of condensers will affect the power factor of any system in which they may be adopted.

The use of the series condenser system in which the condenser is generally in circuit will effectually compensate for lagging currents, provided the condensers are located near the apparatus taking lagging currents, and are in the circuit mainly for the same periods as those in which lagging currents appear.

Though these conditions are not fulfilled in residential districts, yet for the smaller class of property in industrial districts the compensation would be found to be satisfactory, having regard to the fact that over-compensation is an advantage as far as the generators are concerned.

The following is a comparative estimate of the cost of wiring a 6-roomed house with 10 points, on the ordinary "loop-in" system using 200-volt lamps, and on the series condenser system using switchholders.

The estimate is on exactly the same basis for each system, viz., for a plastered house and using 600-megohm cable of English manufacture, in enamelled close-joint steel tubing with slip-socket fittings. The prices include wiring contractor's profit, and labour taken at 1s. 6d. per hour for wireman and mate. The cost of the condenser is not included in (2), as it is assumed that this would be balanced approximately by the cost of a current limiter for system (1).

	(1)	(2)
Cable and conduit	£1 17 6	£1 2 6
Labour on cable and conduit ...	2 10 0	1 6 4
Pendants, switches, main switch and fuses, including labour ...	2 9 2	2 2 6
Lamps	1 10 0	0 15 0
Total	£8 6 8	£5 6 4

These estimates show a saving of 38 per cent. by using the series system, and this has been effected in labour and material due chiefly to the reduction of cable from 17 yd. to 8 yd. per point, and a corresponding saving in labour, conduit and fittings. The prices are for wiring a single house in each case; they would, of course, be considerably lower where a number of houses could be wired at the same time.

Whenever lamps are used in series with a condenser, the power factor is given as the ratio of the voltage on the lamps to the supply voltage. It is obvious that, in the case of a single 10-volt lamp on a 200-volt circuit, the power factor will be 0·05. Since the standard types of meter have not been designed for use on such low power factors, it is an interesting point to consider how far they may be relied on to start and to register accurately in such cases.

A 5-ampere 100-volt induction-type watt-hour meter, which was tested against a sensitive precision wattmeter of the deflectional type, was remarkably accurate at low power factors and as adjusted, *i.e.*, reading nearly 1 per cent. high for a current of 3 amperes at unity power factor, it is more accurate with leading than with lagging currents. With a power factor as low as 0·08 (leading) the meter reads only 2 per cent. low, but reads nearly 5 per cent. low when the power factor is reduced to 0·04.

This type of meter would appear to read sufficiently accurately in connection with the series system, and could be adjusted so as not to register with the condenser alone in circuit, and to start with certainty when the smallest lamp is switched on.

Since in the series system the current is constant, a volt-hour meter connected across the lamps would accurately register the energy used in the lamps, and would reduce the meter losses to a minimum.

Where a number of lamps are run in series, one disadvantage is that, in the event of one lamp failing, all the others go out. In the case of the series system, a cheap type of relay can be adopted, which will automatically short-circuit any lamp thus failing.

Although, for lighting small houses or flats, such relays would appear unnecessary, for public lighting, where reliability is of greater importance, the extra expense might be justified. By arranging for a suitable amount of self-induction in each relay and connecting the lamp switch so as to short-circuit the relay when the lamp is not in use, the presence of the relay will improve the regulation.

This arrangement permits of using lamps whose aggregate of voltage is more than 50 per cent. of the supply voltage, as compared with 35 per cent. when inductances are not used.

The series system is particularly suitable for wiring small houses or flats of five or six rooms—a class of consumer at present almost untouched by electric supply authorities, and the inhabitants of which form the great bulk of the population.

In order to make electricity supply profitable in such cases, it is necessary to adopt a system implying minimum costs to the supply authority, the property owner and the consumer.

An endeavour has been made to show that the series system fulfils these conditions in the first case by the limitation of the maximum demand, and the compensation for lagging currents; in the second case, by the reduction of wiring costs, and in the third by the reduction of the initial cost of lamps and of renewals, as well as the provision of a low candle-power lamp. With these advantages, the system should commend itself to those supply engineers who contemplate the possibility of gaining some portion of that great body of potential consumers who are at present outside their influence.

Where a block of flats or houses can be supplied so as to reduce the cost of the house service to a minimum, an unlimited supply could be profitably given at from 6d. to 9d. per week.

The discussion was opened by MR. PERREN MAYCOCK, who described some of the more recent Lundberg switch arrangements for electric lighting with condensers in circuit, concluding with an example of complete house lighting through a condenser in the kitchen.

MR. RAWLINGS said some description of the apparatus and its size was wanted in the paper, as the size of condenser had an important bearing on its use for domestic purposes. The 5-mfd. size appeared to be too large to use as the author proposed. He thought the condenser for electric lighting purposes had received its death-blow owing to the rapid development of the metal lamp, and this point appealed to him personally, as he had devoted some time to the condenser, although his only had a cubic capacity of 1·4 in., as against the author's 7·5 in. This condenser had been applied to switches and fittings (some examples of which were shown on the lantern screen). He disagreed with the author's estimate for house wiring on the series system, as short-circuiting by switch lampholders was not to be recommended. A better application of the condenser was for dimming light, and for this purpose he had brought out a switch containing a number of contacts and the condenser in the base, and occupying but little more space than a tumbler switch.

MR. W. M. MORDEY thought the author showed that the electrostatic condenser could now be regarded as ranking with the transformer in suitability for practical use. The very small transformer for one or two lamps could not be constructed with a sufficiently low no-load loss, but even with the smallest condenser the losses were very small, in fact, no more than with large sizes. The buffer action of the condenser and self-regulation of the series arrangement were important.

The AUTHOR, in a communicated reply, said: With regard to the use of slip-socket fittings in the comparative estimates of wiring costs, it was not clear that slip sockets were prohibited by the Institution Wiring Rules, provided continuity was obtained by some system of earthing grips; and in any case 99 per cent. of ordinary dwelling houses were wired with slip sockets without any special method of obtaining continuity.

With regard to the size of the condensers, this depended entirely on the factor of safety which was considered necessary. The condensers in use at present were tested at 1,000 volts for use on circuits up to 250 volts. By reducing the straining voltage to 500, it would be possible to reduce the dimensions to about one quarter of the present size. It was not considered advisable, however, to reduce the factor of safety, because it was realised that to extend the use of condensers an absolutely reliable article must be offered.

He did not think the reduction of the dimensions of such importance as was assumed, as the condenser could generally be put in such a position that its dimensions were relatively unimportant.

The Transmission of Electrical Energy by Direct-Current on the Series System.

By J. S. HIGHFIELD, M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, *at Glasgow, June 12th, 1912).*

IN my paper of March 7th, 1907, bearing the above title, I had the privilege of putting before this Institution some facts and theories in regard to this very interesting system. Since writing that paper matters have progressed. After the most careful consideration the Metropolitan Electric Supply Co. decided to use the series system for supplying their western area, and the plant was put to work in March of last year, and has been running steadily ever since. Two sets of colliery winding gear have been constructed, and the

Moutiers-Lyons system (the largest series transmission yet erected by M. Thury) has been largely extended.

The western area system of the Metropolitan Co. is designed ultimately to feed an area containing 300 sq. miles, the extreme distance by road to the remote points from the power station at Willesden being about 28 miles. The company hold, and are now working, the orders in Southall, Hanwell, Brentford and Acton, and possess bulk supply powers in the remaining districts to which it is not certain when the opportunity will arise for giving supplies.

Owing to the small load existing in a great part of the district, the important matter was to design a system which would involve the least possible cost in mains, and, at the same time, admit of ready and inexpensive expansion to meet the requirements of a rapidly increasing population. It was also necessary to use a system which, while being inexpensive for short distances, could be readily extended to very long distances.

It was decided to lay mains having a capacity of 10,000 KW. with sufficient reserve in the case of breakdown, and after much research it was found that two single-conductor cables having a core of 0·125 sq. in. section with ½ in. of paper insulation, sufficient for 100,000 volts direct current, could be laid in iron pipe at less cost than any other system of similar capacity. To provide for continuity of supply in case of breakdown of one of the mains, it was desirable to use the earth as the spare conductor. Further research having shown that this was possible without risk of interference with other electrical circuits, this method with the consent of the Board of Trade, was decided upon; thus, the cost of a third or stand-by cable was avoided.

For the secondary supply the mains are of much less capacity, and can be tapped at frequent intervals to supply small sub-stations for town and village lighting and fairly large power consumers. A somewhat high pressure being necessary for this purpose, it was decided to use three-phase alternate-current mains at 3,000 volts pressure, and for the low-tension system supplying small consumers a three-phase four-wire system at 415 volts pressure

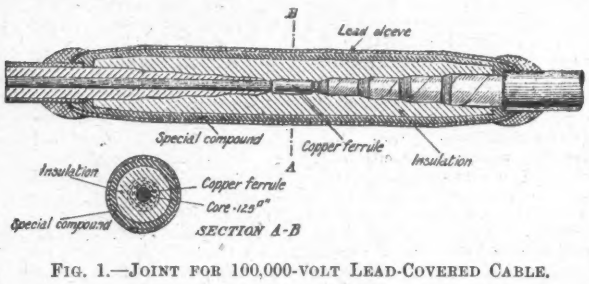


FIG. 1.—JOINT FOR 100,000-VOLT LEAD-COVERED CABLE.

between phases. This network showed lower costs and greater convenience than any other. The comparatively high secondary pressure enables an area of about 10 sq. miles to be worked from each sub-station. Thus in spite of the scattered nature of the demand each sub-station will grow to considerable dimensions, enabling larger plant to be used.

The transmission cable system consists of two plain lead-covered paper-insulated cables drawn into cast-iron pipes 2½-in. inside diameter, the pipe joints being made with yarn and clay, and electrically bonded by means of three corrugated iron wedges which bite into the iron. These wedges make a very good joint and are inexpensive. Special split cast-iron boxes are used to hold each cable joint, and small split boxes are used at bends. There are no brick pits or surface covers; the cable is surrounded throughout its length by cast-iron, thus the cable is admirably protected. The present system supplies from the power station to Southall, a distance of about 7 miles.

The joints in the cables are shown in section in fig. 1, and are made in the following way. The lead is first carefully removed. Steps are made in the paper insulation by carefully unrolling each layer and tearing, not cutting it off to form four steps. The conductors are joined by a sweated sleeve, and the whole is covered by a paper ribbon 1 in. wide, wound on to the joint off a reel. In this way the paper is never handled, and consequently moisture is not left in the joint. A lead sleeve is then drawn over the joint and plumbed to the lead sheath of the cable. It is then filled with compound. The joints are inexpensive, and have proved themselves most reliable.

Each cable length of 220 yards was tested in the factory to 75,000 volts alternating current at 60 cycles, the pressure being applied for 10 minutes. A 6-ft. piece of each length manufactured was tested to 130,000 volts alternating current at 60 cycles, which pressure was resisted for about 5 minutes. The type of joint used was tested at 150,000 volts, 60 cycles, without breaking down. After laying, the whole length of cable was tested to an alternate-current pressure of 20,000 volts, 60 cycles, every 35 minutes.

It was decided to test the cables with direct current at a pressure of not less than 150,000 volts. In order to obtain this pressure a special machine was constructed of a similar type to that used by Mr. Watson in the experiments he has described to this institution, but having a greater capacity. The machine consists of a generator of the Voss type, direct driven by a motor at about 1,000 revs. per minute. The generator and motor are completely enclosed in a cast-iron case, the high-tension terminals for the supply to the

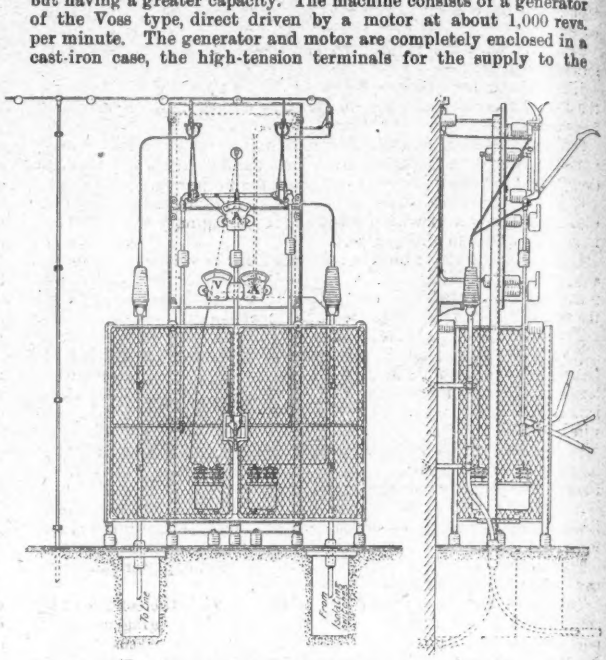


FIG. 2.—MAIN SWITCHBOARD WITH LINE AND EARTH SWITCHE AND INSTRUMENTS.

motor being brought through the case by large ebonite insulators. The case is then filled with nitrogen at a pressure of 200 lb. per square inch. The motor is supplied with current from a small generator which, owing to its direct connection with the motor, is charged at the full pressure; it is therefore necessary to insulate this generator from earth in the same way as the whole machine is insulated. This generator is in its turn driven by a motor by means of two wooden pulleys and a cotton rope which provides ample insulation for the maximum pressure given by the machine. When connected to one cable with its switchgear the machine maintained for periods of about 30 minutes a pressure of 130,000 volts, and for short periods a pressure of 150,000 volts, the total energy put into the cable and switchgear being approximately 500 watts, this leakage being due to small discharges at various points. The pressures were measured by a single-cell Kelvin type voltmeter working in compressed air at a pressure of 200 lb. per sq. in.

I regard the construction of this machine as a notable achievement, and think that Mr. Watson and the makers are greatly to be congratulated.

Each end of each cable is connected to its own switching panel, shown in fig. 2. The panel contains two switches, one for coupling

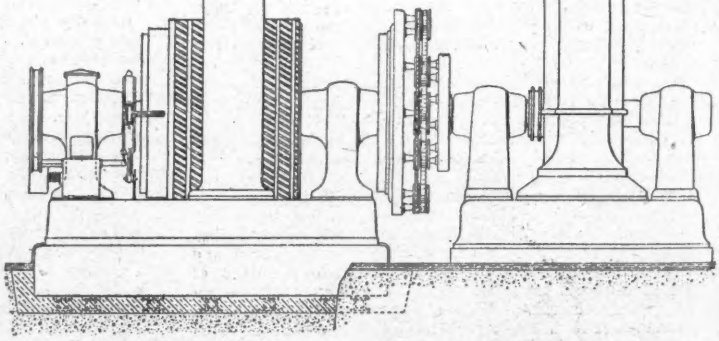


FIG. 3.—MOTOR-GENERATOR, SHOWING INSULATED FOUNDATIONS.
D.C. Generator Output: 100 amperes at 5,000 volts.

the cable to the power station or sub-station circuit, and the other for coupling the station circuit to earth. The two switches are interlocked, so that it is impossible to draw one until the other has been closed. The instruments consist of an ammeter in the line, an ammeter in the earth circuit, and a voltmeter to show the pressure between the line and earth; the latter is provided with a switch, so that it can be conveniently disconnected from the circuit. The panels provide for double insulation, the various instruments and switches being carefully insulated with large porcelain

insulators from the panels; the frames carrying the panels are again insulated from earth. It is a special advantage of the series system that, with the exception of the cable, it is possible to provide double insulation at all points.

It was decided to drive the first machines by means of synchronous motors supplied with energy from the A.C. generators already installed in the power station. Later on, when steam-driven direct-current sets are installed, these machines will form a convenient link between the direct and alternate-current systems. There is nothing special about the synchronous motors, which

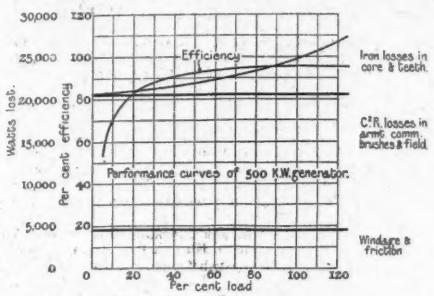


FIG. 4.—PERFORMANCE CURVES OF 500-KW. GENERATOR.

were machines already in the possession of the company. It was for this reason that so low a speed as 200 R.P.M. was chosen.

The direct-current generators shown in fig. 3 have six poles. The commutators are 60 in. in diameter and 6¾ in. long, and contain 1,439 segments. Since the maximum current to be collected is 120 amperes, only two sets of brushes are required. Consequently, not only does the commutator run almost without noise, but the wear is inappreciable. The machines are designed to run sparklessly at any load, but will allow the current to be varied from 70 to 120 amperes. The normal pressure is 5,000 volts; this is the highest pressure for which a machine of this type has, so far, been designed. Therefore, the output of the machine at 100 amperes is 500 KW., and at 120 amperes 600 KW. The performance curves of these machines are shown in fig. 4.

The current is maintained constant by a regulator which serves to regulate the working field by moving the brushes from full to no-load position, and at the same time shunting a part of the field current by means of a diverter. The regulator, shown in the diagram, fig. 5, is driven by a small belt from the end of the generator shaft. It consists of a small turbine C, wholly submerged in oil, maintaining a pressure of about 25 lb. per sq. in. In the case containing the turbine is a vertical cylinder A, in which moves a gate B, on a vertical shaft through a segment of the cylinder. This gate is immersed in oil, and the supply under pressure from the turbine can be directed to either side, so as to rotate with great force the shaft to which it is attached. This shaft is geared by means of bevel wheels to a horizontal shaft, which acts directly on the brush rocker. The supply of oil from the turbine is taken through a small piston valve D, which serves to distribute it to either side of the gate. The position of the main valve is controlled by a solenoid G, through which the main current passes, pulling against a spring E, and controlling a relief valve F. It will be seen

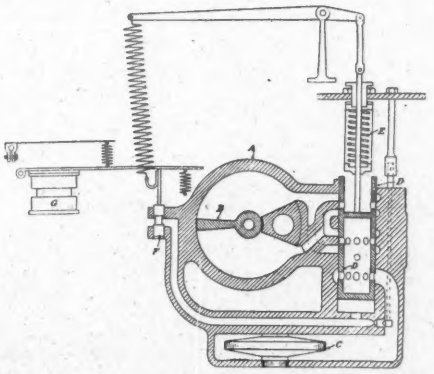


FIG. 5.—DIAGRAMMATIC SECTION OF REGULATOR.

that the governor is of the relay type, and that any variation in the current through the solenoid changing the direction of the flow of oil brings a very large force into action to move the brush rocker and diverter switch. The rocker is mounted on roller bearings, so that it will move with great ease, and, owing to this, and the great force exerted by the regulator, there is very little possibility of failure. In addition to the main spring, there are additional springs to prevent hunting and to provide for the even distribution of load between the machines. The changes in load on the system are not very rapid, and consequently the regulators are not adjusted for regulating at very great speed, but the type of regulator is capable of being adjusted for handling variations from no load to full load taking place in less than 1 second.

The generators are driven through an insulating coupling of the Zodel type, consisting of two disks fitted with pins and rollers for carrying the main forward driving belt, and the reverse belt which is necessary to enable the set to be started from the direct-current end and to keep the whole coupling rigid. This coupling has also a slipping member, which is essentially a disk form of clutch. This is set to slip when the load on the generator exceeds 25 per cent. overload. If the action of the governor could be made instantaneous, this slipping coupling would not be required; but it is a useful device to prevent damage to the generator, and, by slipping, it gives time for the regulator to bring the brushes to the right position to meet sudden changed conditions of load on the system.

In addition to the regulator, each generator is fitted with a short-circuiting switch and operating mechanism, which short-circuits the machine in the event of reversal of direction. This could happen under certain conditions; for instance, if the coupling belt broke on one generator out of several in series, this machine would pull up and reverse its direction; as soon as this occurred the switch would short-circuit the machine and cut it out of circuit. The operating switch shown in fig. 6 for putting the generator into circuit consists of a four-point rotary switch. This is mounted on a pillar, which also carries a carbon break switch, which works in parallel with the rotating switch in such a way as to prevent damage to the latter by the arc formed when the inductive circuit of the generator is opened. In addition, the pillar carries an ammeter to show the current given by the machine, and a voltmeter for measuring the volts across the terminals.

In addition to these switches on the machine, isolating switches are fitted under the floor for the purpose of disconnecting the machine switches from the circuit. These switches have all been

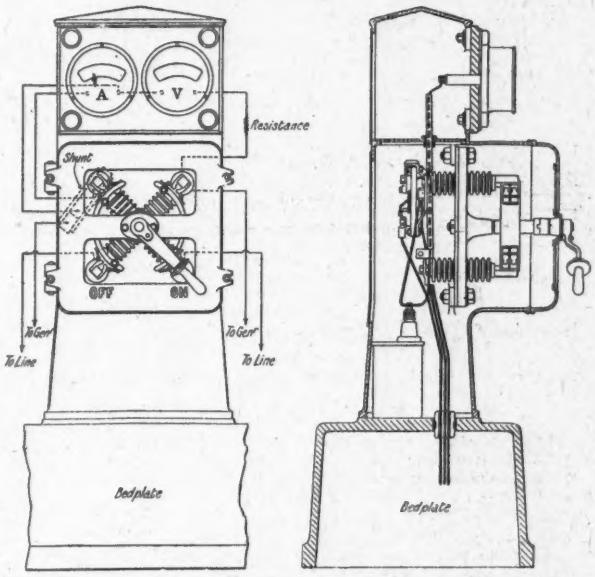


FIG. 6.—GENERATOR SWITCH AND INSTRUMENT PILLAR.

tested with a pressure of 110,000 volts alternating current, applied for about 10 minutes.

The generators themselves are carefully insulated from earth. The details of the foundations are shown in fig. 3. The generators are bolted to concrete blocks, which are supported on stoneware insulators embedded in highly insulating asphalt, the space round the beds being filled in with pure bitumen. This makes a very much sounder job both mechanically and electrically than the older method of supporting the machines on pot insulators.

The object of the whole design of the cable and gear inside the station is to make it practically immune from either mechanical or electrical breakdown; all live metal is doubly insulated from the point where the cables are attached to the switchboards.

The floor itself is constructed of concrete, on which asphalt to the thickness of 2 in. is laid with the greatest care in order to provide the highest possible insulation. Experiment indicated that a floor constructed in this way would require many hundreds of thousands of volts to produce a puncture.

A resistance of 0·8 megohm is fitted to the machine frame, the ends being connected across the terminals of the machine. The centre point of this resistance is connected to the frame of the machine, and, consequently, the total pressure between either pole and the frame is limited to half the pressure given by the machine, and an operator standing on the frame of the machine and touching one pole cannot cannot receive more current than the high resistance will allow to pass. Guards are provided on each machine to prevent accidental contact between the insulated frame of the D.C. machines and the earthed frames of the A.C. motors.

Three motor-generators are now installed at the power station, two being fitted with A.C. motors for starting from the A.C. side; the third machine is always started by means of the D.C. generator.

The plant at Southall consists of three D.C. motors driving three 250-KW. generators supplying three-phase energy at 3,000 volts, 50 cycles, at a speed of 500 R.P.M.

Owing to the high speed at which these machines run, they are,

for their output, smaller, and the commutators are smaller than the generators at the power station. The motors drive the generators through an insulating coupling of a similar type to that used at the power station, but they are not provided with a slipping member. The speed of the machines is kept constant by a regulator of a similar type to that employed at the power station, with the exception that in place of the piston valve being controlled by a solenoid it is controlled by the pressure supplied by the oil turbine. This pressure is balanced against a spring. Since the pressure given by the turbine varies with the square of the speed, a very sensitive speed governor is obtained. Any increase in the speed of the turbine produces an increased pressure which acts on the piston valve which serves to convey the pressure to one or the other side of the gate which controls the position of the brushes. The motor regulator is provided with a supplementary spring, which prevents hunting in the same way as the springs on the generator regulators.

The switchgear in the sub-station is precisely similar to that in the power station, panels of the same type being fitted; the mains are carried to isolating switches from which cables are laid to the starting switches on the machines, the only difference being that ammeters are not required on the motors, and consequently are not fitted. The earthing switches are connected to the earth-plates in a similar way to those at Willesden.

The generators are connected to the main switchboard, from which the 3,000-volt feeders are carried.

(To be concluded.)

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

12,505. "Storing and charging of electric hand lamp and like, secondary batteries and apparatus therefor." W. MAURICE. May 28th.

12,509. "Means for and method of clearing faults on alternating-current systems." A. M. TAYLOR. (Addition to 27,560, 1911.) May 28th.

12,530. "Self-varnishing and fibre-insulating apparatus for covering bare electrical wires, wound direct from the apparatus into coils or used separately." L. FRENKEL. May 28th.

12,545. "Combined transmitters and receivers." W. B. THOMPSON. (Convention date, June 20th, 1911, United States.) May 28th. (Complete.)

12,547. "Telephone exchange systems." E. R. CORWIN. May 28th. (Complete.)

12,556. "Electric hand or pocket lamps." H. W. SCOTT. May 28th.

12,569. "Electric heating and cooking devices." R. F. VENNER. May 28th.

12,592. "Arc lamps." DEUTSCHE BECK BOGENLAMPEN-GESELLSCHAFT M.B.H. (Convention date, May 29th, 1911, Germany.) May 28th. (Complete.)

12,604. "Telephone repeaters." WESTERN ELECTRIC CO., LTD. (Western Electric Co., United States.) May 28th. (Complete.)

12,644. "Telephonic relays and the like." C. H. PRITCHARD. May 29th.

12,645. "Electric machines." W. CURLETT. May 29th.

12,653. "Electro-magnetic curtain-holder (designed especially for theatrical stage drapery curtain)." J. A. PROBST. May 29th.

12,679. "Trolley wheels for use on cars of overhead system electric railways." W. F. SWOVELAND and W. J. HENRY. May 29th.

12,680. "Apparatus for the operation of electrical clocks by electric waves." F. SCHNEIDER. (Divided application on 3,966/12, February 16th.) May 29th. (Complete.)

12,682. "Alternating-current distribution systems." S. D. STRONG and W. E. MCCOY. May 29th. (Complete.)

12,687. "Synchronous motors." L. ROUZET. May 29th. (Complete.)

12,692. "Incandescent lamp sockets." A. SCHUCHARDT. May 29th. (Complete.)

12,701. "Electric fuses." S. D. STRONG and W. E. MCCOY. May 29th. (Complete.)

12,709. "Telegraphic photography." C. STILLE. (Convention date, June 2nd, 1911, Germany.) May 29th. (Complete.)

12,718. "Lugs of accumulators." J. C. WOOD. May 30th.

12,728. "Petrol-electric transmissions." W. A. STEVENS. May 30th.

12,738. "Earthing arrangements for electrical systems." SIEMENS SCHUCKERTWERKE G.m.b.H. (Convention date, May 30th, 1911, Germany.) May 30th. (Complete.)

12,752. "Process for the manufacture of filaments of alloys of tungsten and the like metals." J. HUBERS. (Julius Pintsch Akt-Ges., Germany.) May 30th.

12,757. "Electrical apparatus for medical and other purposes and articles to which such apparatus may be applied." C. H. IVINSON and G. BRYANT. May 30th. (Complete.)

12,761. "Electric boat hoists." SIR W. G. ARMSTRONG, WHITWORTH & Co., LTD., and R. WRIGHT. May 30th.

12,764. "Devices for protecting telegraph lines against inductive action from neighbouring circuits." O. MOLL and P. KESCHEWITZ. May 30th. (Complete.)

12,766. "Bi-polar form wound rotor windings." H. SCHNEIDER. May 30th. (Complete.)

12,775. "Thermo-electric piles or generators." SIR J. W. SWAN. May 30th.

12,784. "Processes of repairing electric incandescent lamps." MAXIM DU MOULIN. May 30th. (Complete.)

12,802. "Electric lamp lock for electric light holders." A. RICHARDS and J. BROCKLEBANK. May 31st.

12,809. "Spark plugs." H. J. C. FORRESTER. (Marshalltown Motor Material Manufacturing Co., United States.) May 31st. (Complete.)

12,833. "Electric conveyors or transporting devices." ELEKTROMOTOREN WERKE HERMANN GRADENWITZ. (Convention date, May 31st, 1911, Germany.) May 31st. (Complete.)

12,834. "Means for and methods of charging and discharging electric accumulators or secondary batteries." A. M. TAYLOR. May 31st.

12,847. "Automatic switching system for telegraphy and the like, and apparatus for the same." J. GELL. May 31st.

12,892. "Friction-clutch gear for use in electric boat hoisting and other apparatus." J. FIELDING. June 1st.

12,908. "Prevention or control of excess voltages in electric conductors." F. A. BECKER. (Convention date, January 5th, 1912, Germany.) June 1st. Complete.)

12,909. "Wall plugs or other couplings for electrical purposes." V. C. H. GIBSON. June 1st.

12,929. "Telephone indicating and metering apparatus." H. VON LASKOWSKI. June 1st. (Complete.)

12,951. "Electric induction machines." SOC. ANON. MONTBARBON. Convention date, June 22nd, 1911, Belgium.) June 1st. (Complete.)

12,952. "Electric induction machines." SOC. ANON. MONTBARBON. (Addition to 12,951/11.) (Convention date, November 8th, 1911, Belgium.) June 1st. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

ELECTRIC WELDING OR SOLDERING. O. Kjellberg. 3,762. February 14th.

ELECTRIC SWITCHES. British Thomson-Houston Co. and E. B. Wedmore. 3,877. February 15th.

METHOD OF, AND MEANS FOR, VARYING ELECTRICAL CAPACITY AND INDUCTION. A. W. Isenthal. 11,209. May 9th.

ELECTROMAGNETICALLY-OPERATED DEVICES FOR CONTROLLING ELECTRIC CIRCUITS. British Thomson-Houston Co. (General Electric Co.) 11,349. May 10th.

SYSTEMS OF ELECTRIC MOTOR CONTROL. British Thomson-Houston Co. (General Electric Co.) 11,351. May 10th.

ELECTROPLATING. E. R. Royston. (Electro-chemical Rubber and Manufacturing Co.) 11,543. May 12th.

APPARATUS FOR MEASURING MECHANICAL POWER OUTPUT. E. C. R. Marks. (Siemens Schuckertwerke Ges.) 12,025. May 18th.

PROCESS AND APPARATUS FOR PRODUCING AND UTILISING MICRO MOVEMENTS, SUITABLE FOR TELEGRAPHIC, TELEPHONIC AND OTHER PURPOSES. J. A. Johnsen. 12,141. May 19th.

SHADE-HOLDERS FOR INCANDESCENT ELECTRIC LIGHTS AND THE LIKE. J. Watkinson and A. E. Payne. 12,571. May 24th.

ELECTRIC LIGHTING OF MOTOR ROAD VEHICLES AND THE LIKE. W. F. Grafton. 13,888. June 10th.

ELECTRIC MOTOR STARTERS. R. H. Barbour. 14,032. June 13th.

CAR LIGHTING OR LIKE SYSTEMS. United States Light and Heating Co. and W. E. Lake. 14,233. June 15th.

SWITCHES FOR CONTROLLING THE ELECTRIC LIGHTING SYSTEMS OF AUTOMOBILES. J. B. Brooks and W. Holt. 15,508. July 4th. (December 27th, 1911.)

ELECTRIC ARC LAMPS. Engineering and Arc Lamps, Ltd., and A. T. Dowdell. 16,678. July 20th.

DISTRIBUTORS OF MAGNETO-ELECTRIC MACHINES FOR INTERNAL-COMBUSTION ENGINES. B. Brooks and F. H. Alston. 16,878. July 24th.

REVERSING SWITCHES FOR ELECTRIC MOTORS. Easton Lift Co. and J. Huggett. 16,919. July 24th.

TELEGRAPHIC SYSTEMS. P. Faiella. 17,151. July 26th. (July 30th, 1910. Addition to 4,920 of 1911.)

TELEPHONES. B. Gwozdz. 17,278. July 28th. (Convention date not granted. Addition to 11,234 of 1911.)

TELEPHONES. B. Gwozdz. 17,300. July 28th. (Convention date not granted. Addition to 11,234 of 1911.)

TELEPHONES. B. Gwozdz. 17,422. July 31st. (Convention date not granted. Addition to 11,234 of 1911.)

TELEPHONES. B. Gwozdz. 17,580. August 1st. (Convention date not granted. Addition to 11,234 of 1911.)

HEATING MEMBER FOR THERMIC TELEPHONES. B. Gwozdz. 17,587. August 2nd. (Convention date not granted. Addition to 11,234 of 1911.)

TELEPHONES. B. Gwozdz. 17,595. August 2nd. (Convention date not granted. Addition to 11,234 of 1911.)

TELEPHONES. B. Gwozdz. 17,820. August 4th. (Convention date not granted. Addition to 11,234 of 1911.)

FIXING THE COVERS OF ELECTRICAL SWITCHES AND THE LIKE FITTINGS. H. J. Railing and G. H. Ide. 18,584. August 17th.

WIRE-COVERING MACHINES. British Thomson-Houston Co. (General Electric Co.) 18,949. August 23rd.

ELECTRIC MOTOR AND OTHER DRIVING ARRANGEMENTS FOR MACHINE TOOLS AND THE LIKE. J. Feyer. 19,162. August 26th.

PLUG AND SOCKET OR OTHER CONNECTIONS FOR ELECTRIC CIRCUITS. J. Lucas and F. Jenkins. 21,419. September 28th.

EMERGENCY BRAKE FOR TRAMCARS AND THE LIKE. E. J. McDermid and G. Jenson. 24,504. November 4th.

PRODUCTION OF HIGH-GRADE STEEL AND SLAG, RICH IN SOLUBLE PHOSPHATES, IN AN OPEN HEARTH OR ELECTRIC FURNACE. Deutsch-Luxemburgische Bergwerksund Hutten Akt.-Ges. and A. Vogler. 27,400. December 6th. (Addition to 19,640 of 1911.)

1912.

REGULATION OF DIRECT AND ALTERNATING-CURRENT DYNAMO-ELECTRIC GENERATORS. Siemens Schuckertwerke Ges. 3,924. February 16th. (February 18th, 1911.)

COVER FOR DIRECT-CURRENT ELECTRICITY METERS. Korting & Mathieson Akt.-Ges. 4,585. February 23rd. (November 10th, 1911.)

WINDING OF THE ROTORS OF DYNAMO-ELECTRIC MACHINES. Siemens Schuckertwerke Ges. 7,574. March 28th. (March 28th, 1911.)

MOUNTING OF FILAMENTS FOR INCANDESCENT ELECTRIC LAMPS. Deutsche Gasglühlicht Akt.-Ges. (Auerges). 873. January 11th. (August 12th, 1911.)

TELEPHONE EXCHANGE SYSTEMS. P. Jensen. (Clement International Engineering Corporation.) 4,984. February 28th. (Divided application on 9,142 of 1911. April 12th.)

TELEPHONE EXCHANGE SYSTEMS. P. Jensen. (Clement International Engineering Corporation.) 5,877. March 8th. (Divided application on 9,142 of 1911. April 12th.)

RESONATING RELAYS. H. von Kramer and G. Kapp. 5,950. March 9th. (Addition to 10,856 of 1911.)

ELECTRODES FOR ARC LAMPS. British Thomson-Houston Co. (General Electric Co.) 6,500. March 15th.

British-made Cables.—At a meeting of the Southwark Borough Council on Thursday last week, Alderman Hewitt gave notice that at the next meeting he would propose that it be an instruction to the Electricity Committee that prices for the supply of cable be only obtained from firms whose works are in Great Britain.